plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

1909-1959

A HALF CENTURY OF SERVICE TO ELECTROPLATING, METAL FINISHING AND ALLIED ARTS

GOLDEN JUBILEE
1959

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GOLDEN JUBILEE ISSUE

JUNE · 1959

7 CLEPO PRODUCTS

Steel Electrocleaner
CLEPO 221-M

Zinc Base Electrocleaner and Surface Reconditioner
CLEPO 50-K

Buffing Compound Remover for All Metals
CLEPO 90-J

Typifying the BROAD CLEPO Service

Aluminum Deoxidant and Desmutter
CLEPO 180-S

Cleaner and Iron Phosphate Coating
CLEPO 196-F

Rust Preventive and Water-Displacing Solvent
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CLEPO 202-S

SEVEN CLEPO PRODUCTS for SEVEN distinctly different types of work in the metal finishing industry. These represent a rough cross-section of the many, many, CLEPO materials used in American Industry today. Whether your problem is the cleaning of metal before electroplating, before painting, between manufacturing operations, or if your work requires barrel finishing, rust prevention, phosphate coating or aluminum welding, it is quite probable that there is a production-tested CLEPO material to suit your need.

CLEPO Field Service Men are available in many areas to help you in choosing the *right* material and method for your job and to show you how to get the best results for your money.

In addition to the standard CLEPO materials, our well equipped laboratories and technical staff stand ready to help you solve the unusual problems and to provide needed technical information.

Finally, in order to provide the utmost in customer service, these CLEPO distributors are ready to help you too.

OUR DISTRIBUTORS TOO, ARE AT YOUR SERVICE

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FREDERICK GUMM Chemical Company Inc.

2-FG6

538 FOREST STREET, KEARNY, N. J.

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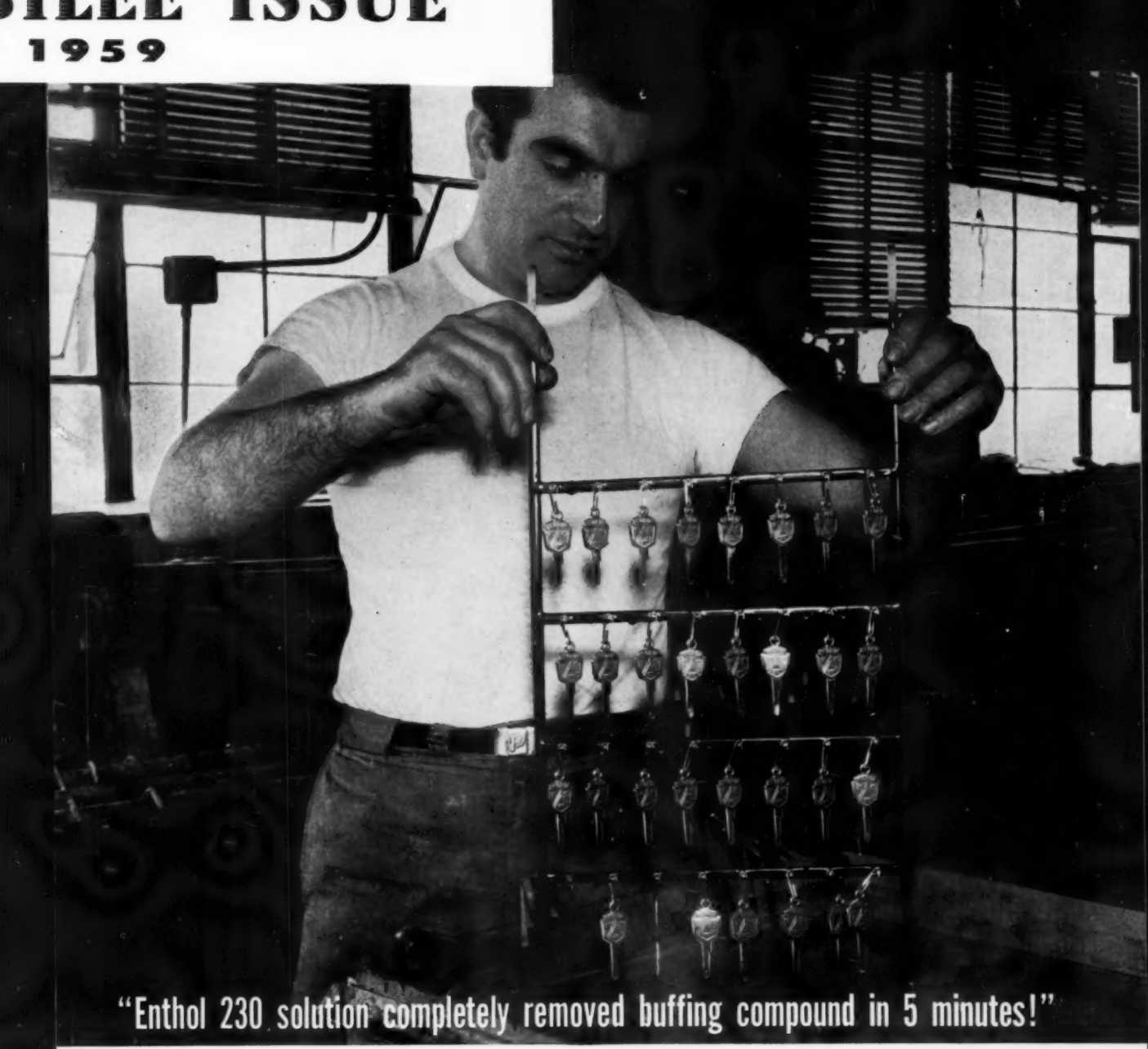

"Enthol 230 solution completely removed buffing compound in 5 minutes!"

At Regal Plating Company, Providence, R. I., these brass keys have just been soaked for 5 minutes in a 3.5% by volume solution of Enthol 230 at 180° F. Buffing compound packed in design work and crevices has been effectively dissolved away.

Regal joins a growing list of platers who have discovered the efficiency of new Enthol 230 in cleaning out the deep crevices, engravings, and filigree work in ornate costume jewelry. As for economy, Regal reports that an 85-gallon tank of cleaning solution required only 3 gallons of Enthol 230 for make-up and 1 gallon for replenishment over a 6 week period! The "ammonia wash" used previously, could not compete with this low operating cost.

Whatever your buffing compound removal problem, this new, mildly alkaline, liquid detergent should solve it. Enthol 230 solutions penetrate and dissolve even hardened buffing compounds, and, in many instances, have eliminated hand brushing of parts. The solutions have extremely long life and high tolerance to contamination by dissolved soils. Enthol 230 solutions can clean steel, zinc die castings, aluminum, copper, brass, white metal, lead, nickel plate, gold, and silver. They are excellent for use in ultrasonic cleaning. Write today for complete information, to Enthone, Inc., 442 Elm Street, New Haven, Conn.

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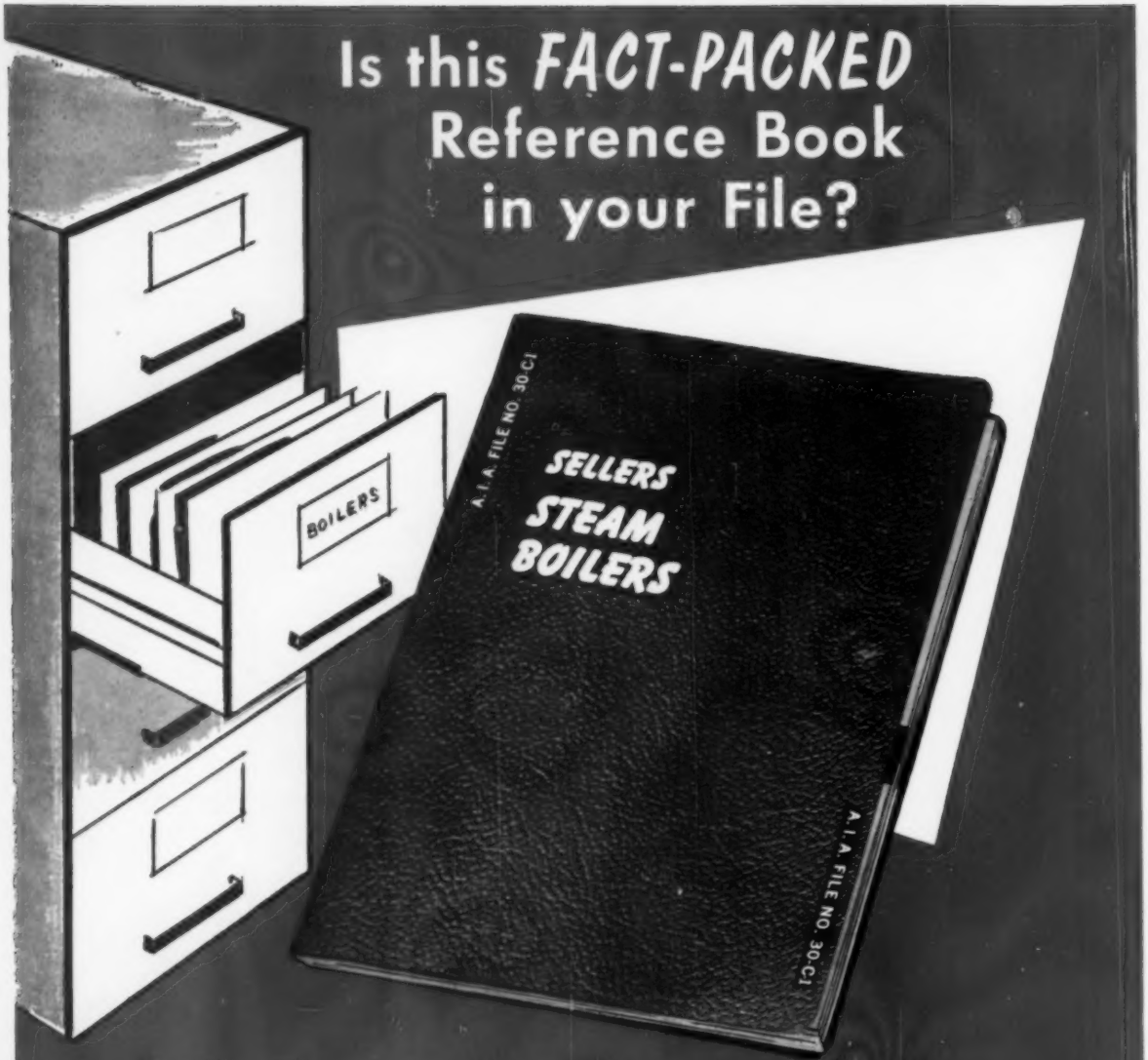

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- Overcoming Building Vacuum and Chimney Back Draft
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- Simple Design, Low Cost Maintenance
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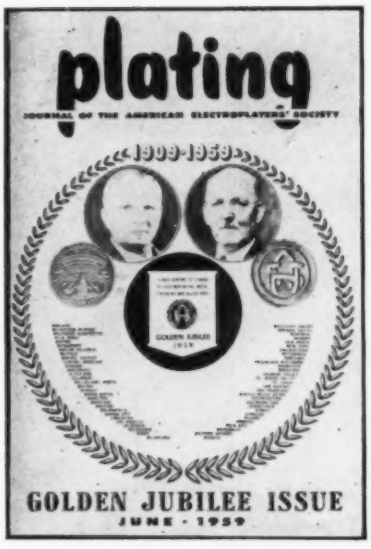

Cover Designed by James A. Civille.

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JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

GOLDEN JUBILEE ISSUE

JUNE 1959 — **Vol. 46, No. 6**

EDITORIAL

Golden Jubilee: Beacon Pointing AES's Road Ahead 555
by Herberth E. Head

The Story of Nickel Plating 599
by George Dubpernell

Tin in Electroplating 617
by Robert M. MacIntosh

Precious Metals 621
by Edward A. Parker

Copper Plating During the Last Fifty Years 628
by Frank Passal

Zinc in the World of Electroplating 639
by Ernest W. Horvick

Kaleidoscope of AES's First Half Century 650
by John P. Nichols

Annual Report, American Electroplaters' Society 665

Golden Jubilee Greetings 688

AES Golden Jubilee Convention Program 691

International Conference on Electrodeposition and Metal Finishing Program 693

Fifth Industrial Finishing Exposition Exhibitors 702

AES Congratulates and Thanks 705

Metal Finishing Suppliers' Association Program 706

National Association of Metal Finishers Program 706

AES Directory 783
AES Membership Report 778
AES News 708
Article References 742
Books 720
Branch News 762
Classified Advertisements 780
Equipment and Supplies 738
Future Meetings 782
Industry News 724
Industry News Briefs 730
Index to Advertisers 784
Intersociety News 710
Patent Abstracts 748
Personals 756
Trade Literature 746

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OFHC Anodes are an example of quality also meaning true economy. There's more *plating* copper per pound, bags and diaphragms are eliminated, scrap loss is reduced, and solution control is simplified.

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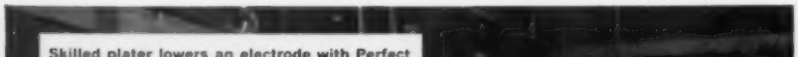
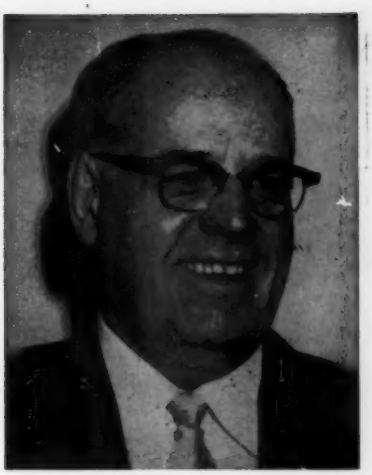
OFHC Anodes—Made Only by American Metal Climax—are Sold by Leading Plating-Supply Distributors Everywhere.



EDITORIAL



GOLDEN JUBILEE: BEACON POINTING AES's ROAD AHEAD

For five decades to date principally because it has never diverted from the goal of its founding fathers, namely to enrich knowledge and stimulate advancement of electroplating, metal finishing and allied arts, American Electroplaters' Society, Inc. (AES) has grown step-by-step to its present stage entirely upon the basis of service and performance.

The Golden Jubilee that AES and its 50 chartered Branches in the United States, 5 in the Dominion of Canada and 3 in the Commonwealth of Australia have celebrated through diverse Anniversary educational and institutional activities since July 1, 1958 is being climaxed not only by this Golden Jubilee Issue of its Plating Magazine but also by the vast Golden Jubilee Convention and Industrial Finishing Exposition, including their concurrent Fifth International Conference on Electrodeposition and Metal Finishing, being conducted in Detroit, Michigan, June 15–19, 1959, with AES's dynamic Detroit Branch as Host.

There, will assemble AES's largest number of members, their families and their guests, including many visitors from other countries, in the Society's five-decade lifetime to date. These will share in the Convention's numerous fellowship, relaxational and plant visitational activities. They will also be educationally enriched by the exhibits and displays of latest equipment and processes of the industry's sources of supply at the Exposition, and by the technical and scientific papers of the largest number of the world's experts ever to participate in an AES international conference in the AES's half-century history.

To each of these, whether as participant, audience, well-wisher or in any other capacity, American Electroplaters' Society extends its hearty appreciation for cooperation in the success of this climax of its Fiftieth Anniversary, stepping stone into its next half-century of service to electroplating, metal finishing and allied arts, and consequently to the public welfare.

And to you its Plating Magazine readers, may this Golden Jubilee Issue not only merit your present large interest but may it also serve you, for years to come, as both a worthy AES reference source and as a memento of this significant Fiftieth Anniversary, beacon pointing AES's road ahead.

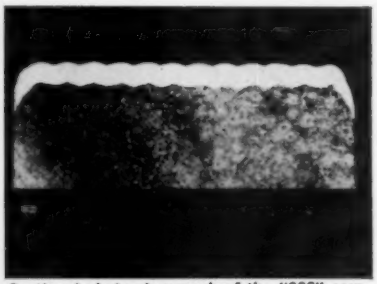
Herberth E. Head

National President

◀ INDICATE A 603.

Skilled plater lowers an electrode with Perfect Circle piston rings into a bath of Mutual® Chromic Acid.

Photo shows the Perfect Circle "200" chrome top compression ring (L) and "98" self expanding oil ring (R). The face of the compression ring and the steel rails of the oil ring are plated with solid chrome .004"-.007" thick.



Sectional photomicrograph of the "200" compression ring shows interrupted surface and thick plating of chrome.

FOR PRECISION CHROME PLATING PERFECT CIRCLE USES MUTUAL CHROMIC ACID

Perfection is the goal in producing piston rings. Each is machine tooled to exacting specifications and the chrome plating must be flawless. To safeguard against plating difficulties . . . and expensive rejects . . . Perfect Circle Corporation relies on Mutual Chromic Acid. Like many experienced platers, Perfect Circle knows that careful control, plating skill plus Mutual Chromic Acid add up to a top quality chrome finish.

Mutual Chromic Acid is always 99.75% pure—or better. Sulfate content never exceeds 0.1%. Rigid quality control by Mutual insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the acid-sulfate ratio of your plating bath.

To obtain further information about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to offer help or information at any time.

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SOLVAY® Ammonium Bicarbonate ■ SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide ■ SOLVAY Methylene Chloride

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SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

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8-6

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GOLDEN JUBILEE MESSAGE
TO
INDUSTRIAL ADVERTISERS

CREATED as the official magazine of the National Electro-Platers Association of the United States and Canada (NEPA) approximately a year after the birth in 1909 of that corporate body that was transformed into today's American Electroplaters' Society (AES) in 1913, QUARTERLY REVIEW, serving electroplaters and metal finishers, blossomed into MONTHLY REVIEW in 1914 and became this day's PLATING MAGAZINE in January 1948.

Property of the AES, then and now, and tailored specifically for AES members, these comprising the leadership and the rank and file of much of the plating and metal finishing enterprise of this dynamic industry, this magazine has been an educational and informational reliance in electroplating, metal finishing and allied arts for practically five decades.

Through its advertising columns first inaugurated a quarter-century ago, PLATING, moreover, has provided means to this field's industrial advertisers, at moderate advertising space rates, to merchandise their products effectively to the large, fertile and expanding plating and metal finishing market served by it, a monthly magazine, internationally reputed, enjoying the largest paid circulation in this field. In fact, as AES launched its GOLDEN JUBILEE year observance on July 1, 1958, PLATING's paid circulation margin over closest contender in the East North Central, Middle Atlantic and New England sections of the USA, principal concentration areas of plating and metal finishing, exceeded 1500 paid subscribers in these three major regions alone.

Hundreds of product advertisers have employed PLATING advertising in the last quarter-century. Indeed, an impressive number of these have consistently advertised in PLATING for twenty or more years, renewing their contractual relationship year after year thereby demonstrating continuing confidence in it as an advertising medium.

Proudly, these are listed in PLATING's "Golden Circle of Advertisers" published in its current booklet, "Market Data and Media File" (yours free for the asking). They are also identified in the panel that is a featured part of the PLATING MAGAZINE section of the FIFTIETH ANNIVERSARY LOUNGE at the AES's Fifth Industrial Finishing Exposition that YOU are most cordially invited to visit when attending the AES's GOLDEN JUBILEE CONVENTION in Detroit, June 15-19, 1959.

If YOUR company is not now advertising in PLATING, its patronage is invited. Without obligation of any sort, request a copy of the foregoing popular booklet and for the magazine's latest Publishers Statement and Rate Card. Appraise. Compare. Invest in PLATING advertising. Your product and institutional merchandising will benefit from PLATING prestige, coverage and other values.

FOR COMPLETE STORY, write or phone today!

445 Broad Street, Newark 2, New Jersey

Telephone: HUmbolt 2-3400

FIFTY YEARS AGO a group of far-sighted individuals banded together for the purpose of accelerating the advancement of electroplating and metal finishing and acquainting industry with its many advantages.

Today, we can trace the tremendous strides made in this field, directly to the tireless efforts of AES.

The wealth of technical knowledge and the skills they have contributed have played an important part in the successful growth of many of our great industries.

Northwest Chemical Company is proud to have been a long-time participant in the vigorous AES research program. We extend our warmest congratulations for the completion of this half-century of outstanding achievement and service.

Congratulations

AMERICAN ELECTROPLATERS' SOCIETY

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

make NORTHWEST products BETTER!

the invisible ingredients

Northwest Chemical quality is equal to any in the field. Their formulas are based on careful research and long experience. The steady growth of the company and the acceptance of their products is due to the invisible ingredients compounded in each shipment going into a customer's plant.

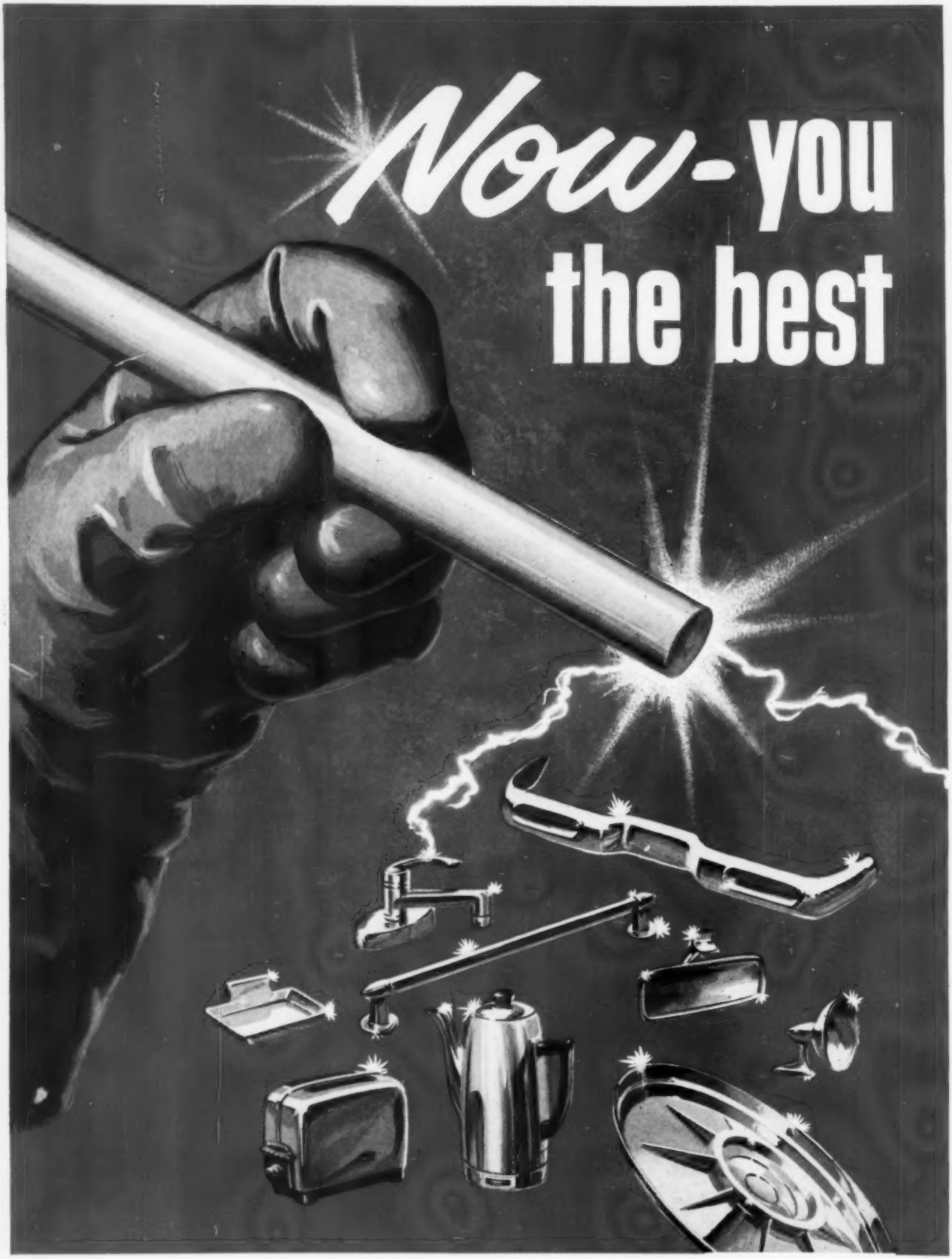
Those ingredients which give Northwest Chemical customers a superior product are the careful, individual attention given each customer's requirements, expert analysis of the job to be done plus the technical ability and experience to produce basic formulas to exactly the point of top efficiency in each case and by constant stand-by service, to keep them that way.

That is the reason Northwest Chemicals are specified by an ever increasing number of the country's top manufacturers.

Remember—the cost per finished article is the true cost of your cleaner. Northwest's stand-by service keeps the job right.

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 606.

can have Electrolytic Cleaners ever developed

Reduce Rejects! Reduce Re-runs! Increase Production!

There is a DETREX process for all your cleaning needs—
Zinc, Steel, Brass, Copper, Nickel, etc.

"Progress" is another word for DETREX. By continuing research in the laboratory and in the field, plus a constant awareness of new methods and techniques, DETREX has developed cleaning processes for the Electroplating industry that have been needed for years.

These new processes assure absolute removal of buffing and polishing compounds, and all other intentional soils. Your present equipment is adequate for these new processes.

Whatever your cleaning requirement, and regardless of your location, a DETREX Engineer will be glad to give you complete technical information on these important new developments. *To keep pace with progress—write today to:*

DETREX CHEMICAL INDUSTRIES, INC.

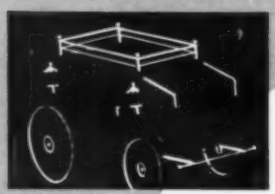
Box 501, Dept. P-659, Detroit 32, Michigan

See Us at Booths 63 and 64 Industrial Finishing Exposition, Detroit Artillery Armory

HARSHAW

60 years

THROUGHOUT THE PAST 60 YEARS, THE HARSHAW RESEARCH LABORATORIES HAVE PROVIDED MANY DEVELOPMENTS AND IMPROVEMENTS WHICH HAVE SERVED TO PROMOTE THE GROWTH OF THE ELECTROPLATING INDUSTRY. INCLUDED AMONG THESE MANY ADVANCEMENTS ARE THE FOLLOWING OUTSTANDING EXAMPLES:



1927 Rolled depolarized nickel anodes.

1934 NIBRITE...The first commercial bright nickel electroplating process accepted by the automotive industry.

1935 ACID TIN ADDITION AGENT developed.

1936 XXX CAST CARBON ANODES...This special composition carbonized nickel anode was developed for use in bright nickel solutions.

1937 METAL FLUOBORATES used commercially for electroplating.

1945 PERFLOW...The first truly leveling, sulfur free nickel deposit.

1946 GRANULAR NICKEL SALTS...fine crystal free flowing single nickel salts of high purity.

1952 PERGLOW...Outstanding bright nickel with excellent leveling.

1953 PERFLOW-PERGLOW DUPLEX Nickel plate with unmatched corrosion resistance.

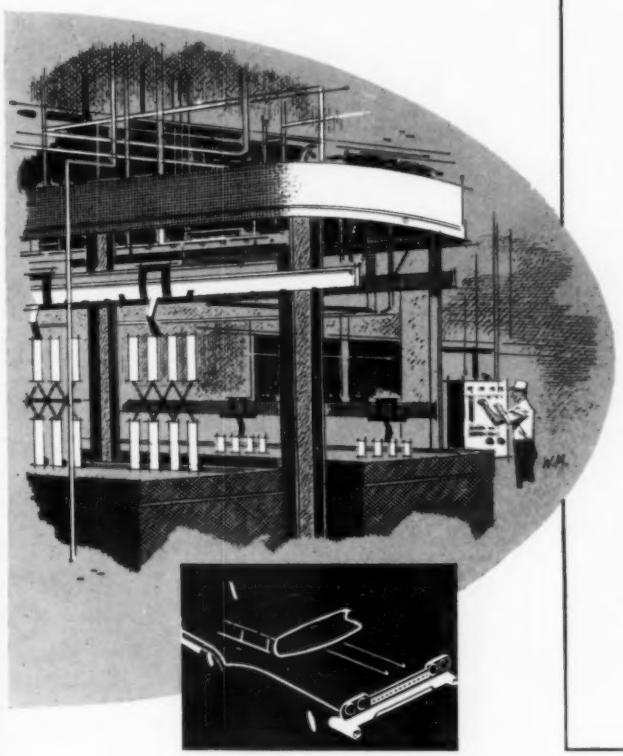
1955 AIR AGITATION...Adaptation for use in Harshaw nickel processes.

1958 CYNOREX COPPER...Exceptionally simplified bright cyanide copper process.

We will continue to offer platers complete service, including full programs of research and development in addition to complete plating processes, anodes, and chemicals

working for Platers

Nickel salts, nickel anodes, and cyanide of potash were Harshaw products produced for the Plating Industry as early as 1899. This modest beginning grew continuously to where our service to Platers includes full programs of research and development, many plating processes, and a complete line of chemicals and anodes. We will be happy to send further information on any of the items listed here—ask us for it.



HARSHAW PLATING PROCESSES:

Acid Tin
Tin Fluoborate
Lead Tin Alloy
Lead Fluoborate
Cadmium Fluoborate
Copper Fluoborate
Nickel Fluoborate
Cynorex Copper (High Speed Cyanide)
Cuprex Copper (Acid)
Perglow Bright Nickel
Nubrite Bright Nickel
Nubrite Bright Nickel (Air Agitated)
Airglow Bright Nickel
Modified XXX Bright Nickel
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Perflow Semi-Bright Nickel (Air Agitated)
Perflow-Perglow Duplex Nickel
Lead — Tin Alloy Plating
Nibrite Barrel Nickel
Super Nibrite Barrel Nickel

CHEMICALS AND ANODES FOR MOST PLATING NEEDS:

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Activated Carbon
Airglow Nickel Plating Addition Agents
Anocaps — Rubber Anode and Hook Protectors
Bags, Anode
Baskets, Anode
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Cadmium Ball Anodes
Cadmium Fluoborate
Cadmium Oxide
Cadmium Plating Addition Agent
Caustic Soda
Caustic Potash
Chromic Acid
Containers, Ball Anode
Copper Ball Anodes — Forged and Cast
Copper Cyanide
Copper Fluoborate
Cynorex Copper Plating Addition Agents
Cuprex Copper Plating Addition Agents
Filter Aid
Fluoboric Acid
Hydrofluoric Acid
Hydrofluosilicic Acid
Hooks, Anode
Lead and Lead Alloy Anodes
Lead Fluoborate
Lead Plating Addition Agents
Nibrite Barrel Nickel Plating Addition Agents
Nickel Acetate
Nickel Anodes — Rolled and Cast
Nickel Anodes — Toll Cast
Nickel Carbonate
Nickel Chloride
Nickel Formate
Nickel Fluoborate
Nickel Salts, Single
Nubrite Nickel Plating Addition Agents
Perflow Nickel Plating Addition Agents
Perglow Nickel Plating Addition Agents
Potassium Cyanide
Potassium Stannate
Rochelle Salts
Silver Cyanide
Sodium Cyanide
Sodium Stannate
Super Nibrite Barrel Nickel Plating Addition Agents
Tin Aluminum Alloy Anodes
Tin Anodes — Ball and Cast
Tin Chloride
Tin Fluoborate
Tin Sulfate
XXX Bright Nickel Plating Addition Agents
Zinc Anodes — Ball, Basket Type and Cast

THE HARSHAW CHEMICAL COMPANY

1945 EAST 97th STREET · CLEVELAND 6, OHIO

Chicago 32, Illinois · Cincinnati 13, Ohio · Cleveland 6, Ohio · Detroit 28, Michigan
Hastings-On-Hudson 6, N.Y. · Houston 11, Texas
Los Angeles 22, Calif. · Philadelphia 48, Pa. · Pittsburgh 22, Pa.

Congratulations to
AES *on its 50th*
ANNIVERSARY

End view over payoff reels. Machine is compact, only 13′ by 104′.

New Meaker Anodizing machine delivers uniform high quality plus versatility

This Meaker anodizing machine was built to meet the requirements of the Allmetal Weatherstrip Company. It handles aluminum strip in widths up to 18″, thicknesses from .0071″ to .032″, and at speeds from 2 to 6 FPM. In the illustration above, five strips are running simultaneously at 3 feet per minute, producing a total of 900 lineal feet of anodized and waxed aluminum every hour.

Meaker engineered and supplied this installation complete with every detail, including: a 6000 ampere generator, refrigerating unit, ice bank, hot air blowers, payoff and take-up reel systems, and the Meaker-built anodizing and wax dip unit itself.

Why don't you take advantage of Meaker's complete service when you need plating and anodizing equipment . . . it's backed by a reputation for building the best for 50 years.

Arrangement of take-up reels allows easy removal of aluminum rolls to forming operations.

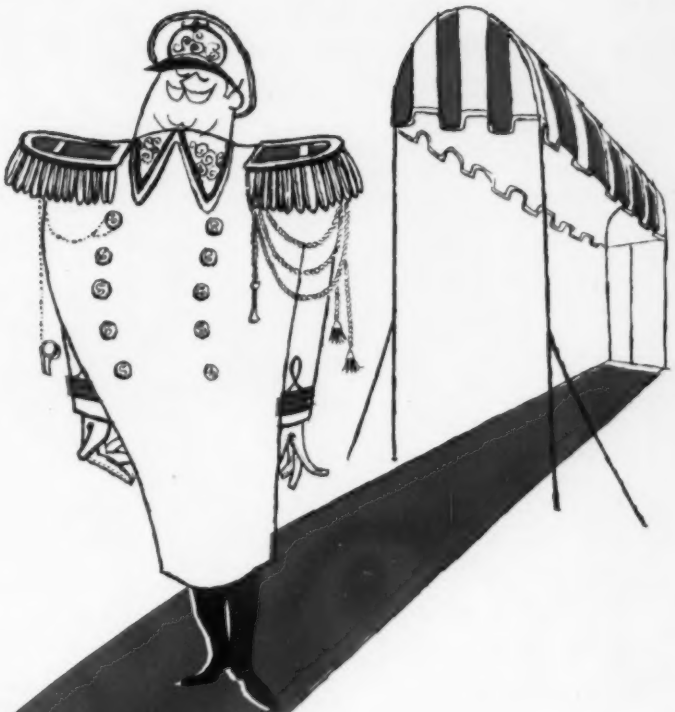
MEAKER

Write for further information

THE MEAKER COMPANY • 1629 S. 55th AVE. CHICAGO 50, ILL.

BOOTH NO. 81

ROHCO® has the Red Carpet Out For You...



Visit the high spot of the Industrial Finishing Exposition!

You will see the ROHCO "parade of stars"—new Control and Test Equipment, a Portable Heat Exchanger, new RODIP Conversion Coatings for Zinc, Cadmium and Aluminum—and the latest ROHCO addition agents for plating. It will be rewarding to you to see and learn about these and other new developments to make your plating better and more profitable.

Stop in often while at the Exposition. Make the ROHCO Booth your headquarters to meet and see your friends!

ROHCO

Nationwide Stockpoints

R. O. HULL & COMPANY, INC.

1302 Parsons Court Rocky River, 16, Ohio

THE RIGHT START...A BETTER FINISH

BIGGEST

★ COATING PLANT WEST OF CHICAGO ★

WITH WALL-TO-WALL DAVYNOL!

We dip-coat parts up to 4 feet in diameter and 16 feet long. We spray-coat parts up to 6 feet in diameter. DAVYNOL coatings vary from 3 mils to 3/16" thick. One to 5 coatings . . . whatever your application demands.

DAVYNOL PVC-100

- Resists Chemical Corrosion
- Blocks Current Flow!
- Prevents Electrical Shock!
- Absorbs Impact!
- Deadens Noise!
- Slashes Maintenance Costs!

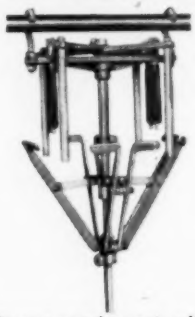
SEND US YOUR INQUIRY ! ! !

3000

.... COUNT 'EM .....

3000

CUSTOM DESIGNS FOR PLATING AND ANODIZING RACKS



We fit your requirements with stock designs, or engineer fixtures like this one for special purposes. Davies racks are built of selected materials and coated heavily with DAVYNOL to lengthen their useful life.

WRITE TODAY FOR DETAILS!!!

..... DAVIES-RANDOLPH TRANSFER PUMPS

BARGAIN!

Handle any solution.
No metal part ever touches liquid.

BARGAIN!

Model 500—Capacity 54 GPH
Model 610—Capacity 246 GPH

WRITE FOR LOW PRICES ! ! !

SEE THE

AMAZING UNI-BOLT

New Electrode Rod Insulator!

One-piece steel, heavily coated with DAVYNOL. No spacer needed. Easy to install. Standard sizes stocked. Universal application.

ASK US ! ! !

Davies®

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Unit Process Assemblies

. . . and leading manufacturers of: buffs, compounds, blasting and tumbling equipment, tanks, and rectifiers.

COMPLETE PLANT ENGINEERING SERVICE

Come one ★ Come all

See Us in Booth 249

Whether it's a heavy-duty grinding job or a case of real fine polishing, METALITE® abrasive cloth is the answer. Available in belts, discs, sheets and hundreds of special shapes and sizes to fit every production need. A new METALITE Booklet gives you the whole story. Write for your copy today to Dept. PL-6.

BEHR-MANNING CO.
TROY, NEW YORK
A DIVISION OF NORTON COMPANY

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
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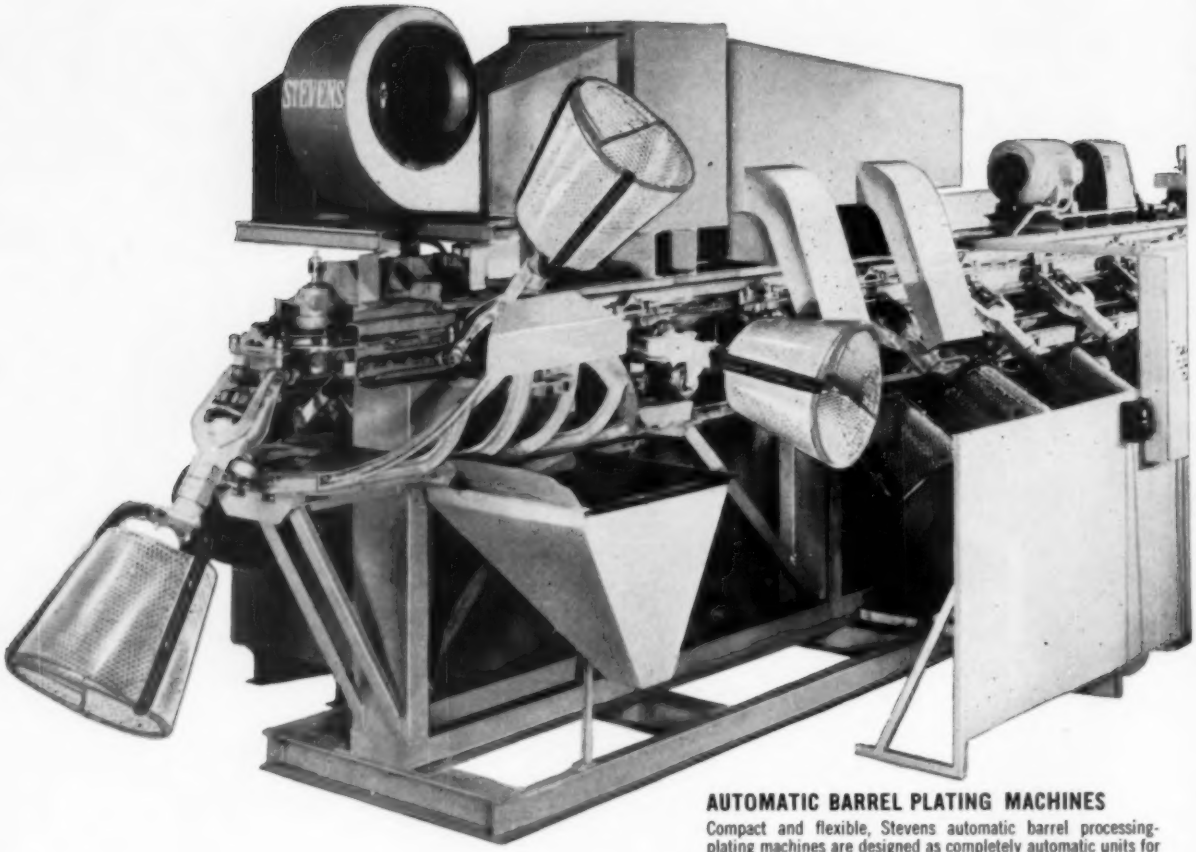
In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U.S.A.



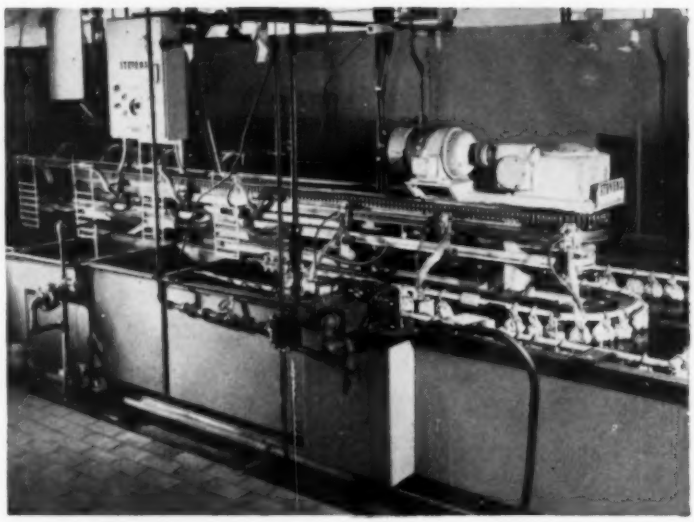
AUTOMATIC BARREL PLATING MACHINES

Compact and flexible, Stevens automatic barrel processing-plating machines are designed as completely automatic units for integrated manufacture. They provide for the most economical and rapid plating of small parts.

STEVENS...TIME-TESTED SOURCE

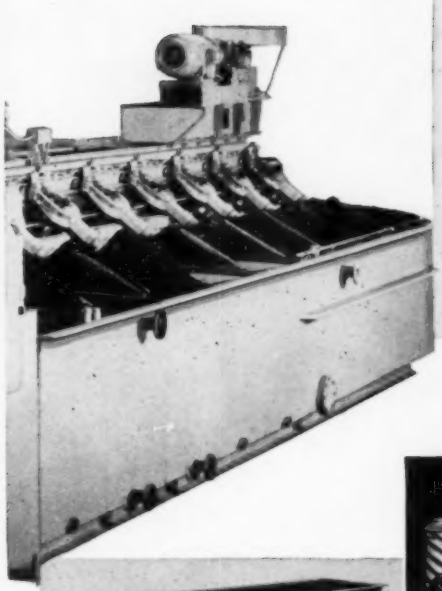
For more than fifty years, Frederic B. Stevens Inc. has been a leader in the development and sale of prefinishing and plating equipment and supplies. If you have parts to buff, polish, clean and plate, this experience is yours for the asking —and naturally the equipment to do this work incorporates the latest techniques for high production and lower costs.

This Stevens catalog in miniature is an example of our wide range of equipment and supplies. Pick out what you need — then get in touch with your local Stevens representative. He'll tell you what you want to know—specifications, prices, delivery dates, everything.



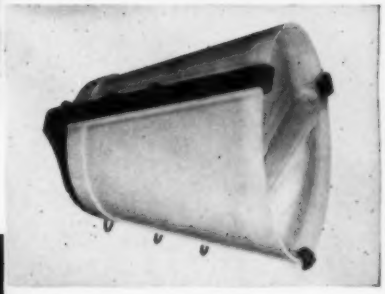
LITTLE STEVE PLATING MACHINES

Almost every electroplater likes the "Little Steve." It's tops for such applications as electroplating, anodizing, enameling bright dipping and phosphating. "Little Steve" can fit into almost any existing factory layout.



ROTO-FINISH VIBRATRON

New and revolutionary method for fast mechanical finishing. Entire abrasive mass is agitated so that media are used more efficiently. Equipment proved. Minimum wear. See your Stevens representative for details.



POLY-CARB BARRELS

New, lighter, stronger, longer lasting oblique barrel cylinders are now introduced by Stevens. Withstand temperatures upwards of 250°. Stevens also furnishes barrels in Plex-i-glas, Tempron and Plastisol-covered steel.

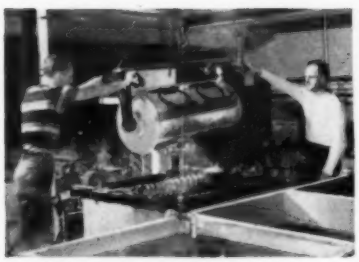
STILL TANKS

Stevens can supply you with still tanks built of steel, stainless steel, aluminum, also Koroseal lined, rubber lined, lead lined. Stevens will design special purpose tanks for specific needs.

BUFFING-POLISHING COMPOSITIONS

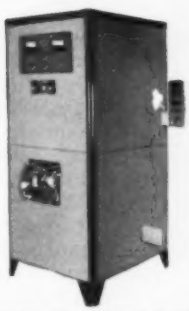
Stevens can furnish either liquid or bar compositions for every use from coloring thin gold flash to buffing nickel-plated bumpers. Ask for the Stevens L. V. compositions catalog.

FOR FINISHING and PLATING NEEDS



HORIZONTAL BARRELS

Where the situation is appropriate for horizontal barrel lines, Stevens will engineer and supply such systems for you. Cylinders are furnished in Tempron or Plex-i-glas.



SILICON OR SELENIUM RECTIFIERS

Highly efficient Stevens rectifiers are built for tough use over long periods of time. A large selection of standard models is available. Special models built on order.

PLATING AND FINISHING SUPPLIES

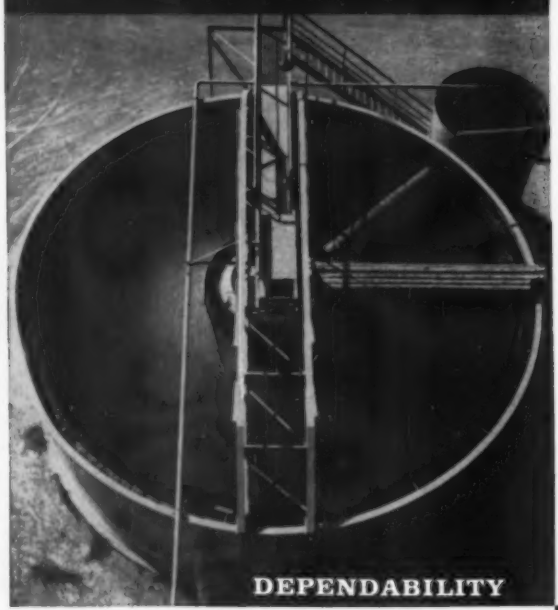
Chemicals and supplies for all plating and finishing operations. Anodes, cleaners, filters, buffs, compositions and Hydra-Blast supplies and equipment. Prompt delivery of whatever quantity you need is assured from your nearest Stevens branch.

frederic b. **STEVENS,** inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN INDIANAPOLIS SPRINGFIELD (OHIO)

IN WASTE TREATMENT FOR THE PLATING INDUSTRY



GRAVER Offers

SAVINGS • SIMPLICITY • DEPENDABILITY

SAVINGS in a TV antenna plant. Graver ion exchange system results in savings of $2,000 a month on plating operation through elimination of bath dumping. System restores original bath quality and provides for better rinsing.

SIMPLICITY in a missile plant. Plating of missile parts requires over 10 processes resulting in chrome, cyanide, acid and alkali wastes. These wastes are collected from 120 plating tanks into three streams and treated by an integrated Graver plant providing for destruction and reduction of wastes. Central control board, simple operating charts keep operator time to a minimum.

DEPENDABILITY in an electronic controls plant. Cyanide, chrome, acid and alkali are treated separately and then sent to a Graver Reactivator® for complete precipitation of metals from water. Positive clarification is achieved on every load, as it has been since the treatment system was installed more than two years ago.

Your waste treatment plant can incorporate all three advantages. Perhaps no recovery is possible or desirable at your plant, yet you still get simplicity and dependability and save because of them through low requirements on equipment, time, labor and maintenance. Perhaps automatic operation is not indicated, yet with Graver you still get the simplest operating plant possible plus the other advantages. Graver offers equipment for all types of plating waste treatment in a wide range of industries. Our experience and the high quality design and construction of our units assure the most advantages in your waste treatment plant.

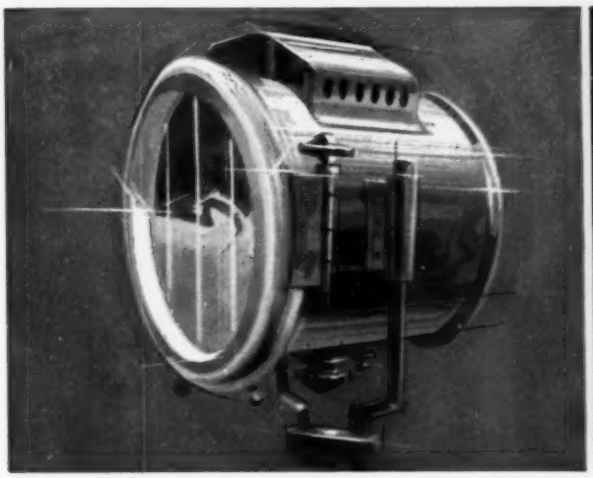
Request literature! Tell us about your plating problem and we will send you a case history study of how a similar problem was solved and how one plant, representative of many, benefited from Graver's trio of advantages—savings, simplicity and dependability.

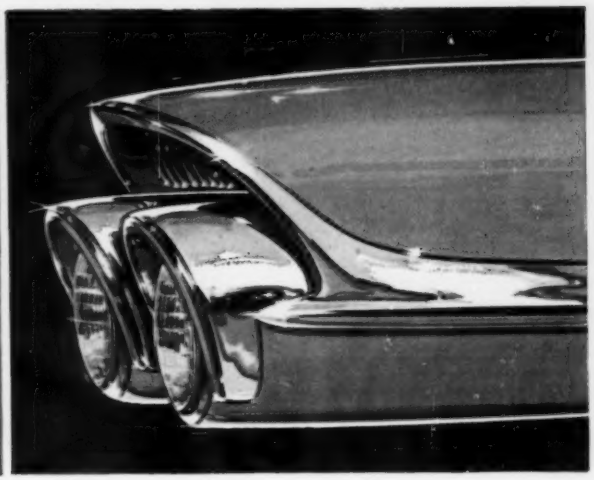
GRAVER

Industrial Waste Treatment Dept. W-523
GRAVER WATER CONDITIONING CO.
Division of Union Tank Car Company
216 West 14th Street, New York 11, N. Y.

Half a century apart . . .

both finished by Acme machines!





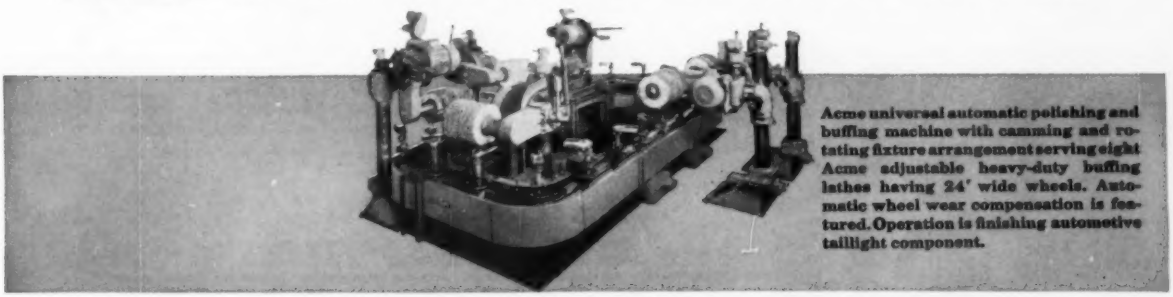
Even in 1910, part of an owner's pride in his car lay in gleaming brightwork. But polishing and buffing the shiny metal that he loved so well caused manufacturers plenty of headaches. And so they turned to Acme—and Acme has continued to supply the answers to their finishing problems.

Today, Acme engineers combine standard units with a variety of accessories to make custom polishing and buffing machines. Large corporations and small job shops alike use Acme machines to reduce rejects, increase production volume, machine finish odd-shaped pieces.

Every year of its history, Acme has encountered new finishing requirements—each an individual problem—and solved them. Chances are, we can solve your problem, too. Send for illustrated 16-page catalog today.

50 years of *Polishing Off* your finishing problems

***OPEN HOUSE** AT ACME DURING THE AES Convention IN DETROIT—JUNE 15 - 19—DON'T MISS IT!*



Acme universal automatic polishing and buffing machine with camming and rotating fixture arrangement serving eight Acme adjustable heavy-duty buffing lathes having 24" wide wheels. Automatic wheel wear compensation is featured. Operation is finishing automotive taillight component.

ACME MANUFACTURING COMPANY

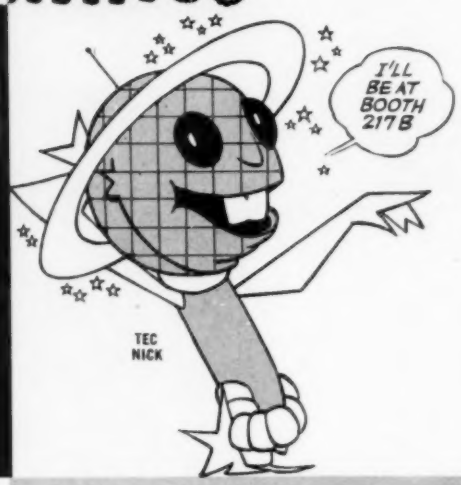
1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

Electroaurotechnics

A big word, but to us at Technic an important one, for our more than 50 years combined experience in the field of Precious Metal Plating Metallurgy is continually being used to improve and develop new soluble golds, and application procedures for the electro deposition of gold and gold alloys to meet the ever changing technological requirements of today and tomorrow.

We are justly proud of our reputation for solving tough problems, and for the millions of dollars saved by the adoption of our Electroaurotechnics and superior soluble golds, among which are:



Technic
INDUSTRIAL 24 Kt GOLD → (aqueous) the world's purest soluble gold, specified and used by many leaders in the Missile, Atomic and Electronic fields.

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OROSENE 999 Patent Pending
24 Kt Acid Bright Gold → The first NEW development in gold electroplating in over 100 years. It produces electroplates both hard and ductile using ONLY ONE addition agent operating at room temperature under POSITIVE and simple control.

Technic
H.G. BRIGHT 23+ Kt GOLD → The only bright gold operating with less than 1/10 ounce free cyanide per gallon at room temperature, offering variable hardness to fit your specifications . . . at a non-premium price.

We would also like to call your attention to **Technic's**
RHODIUM SULPHATE T.P. → A superior rhodium concentrate of high purity offering low stress deposits and tight grain structure.

Full information on these superior soluble metals is available upon request . . . also the complete resources of our laboratories, and the most experienced Precious Metal Plating metallurgists in the world are at your service, without obligation. Phone, TWX, wire or write.

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Technic inc.

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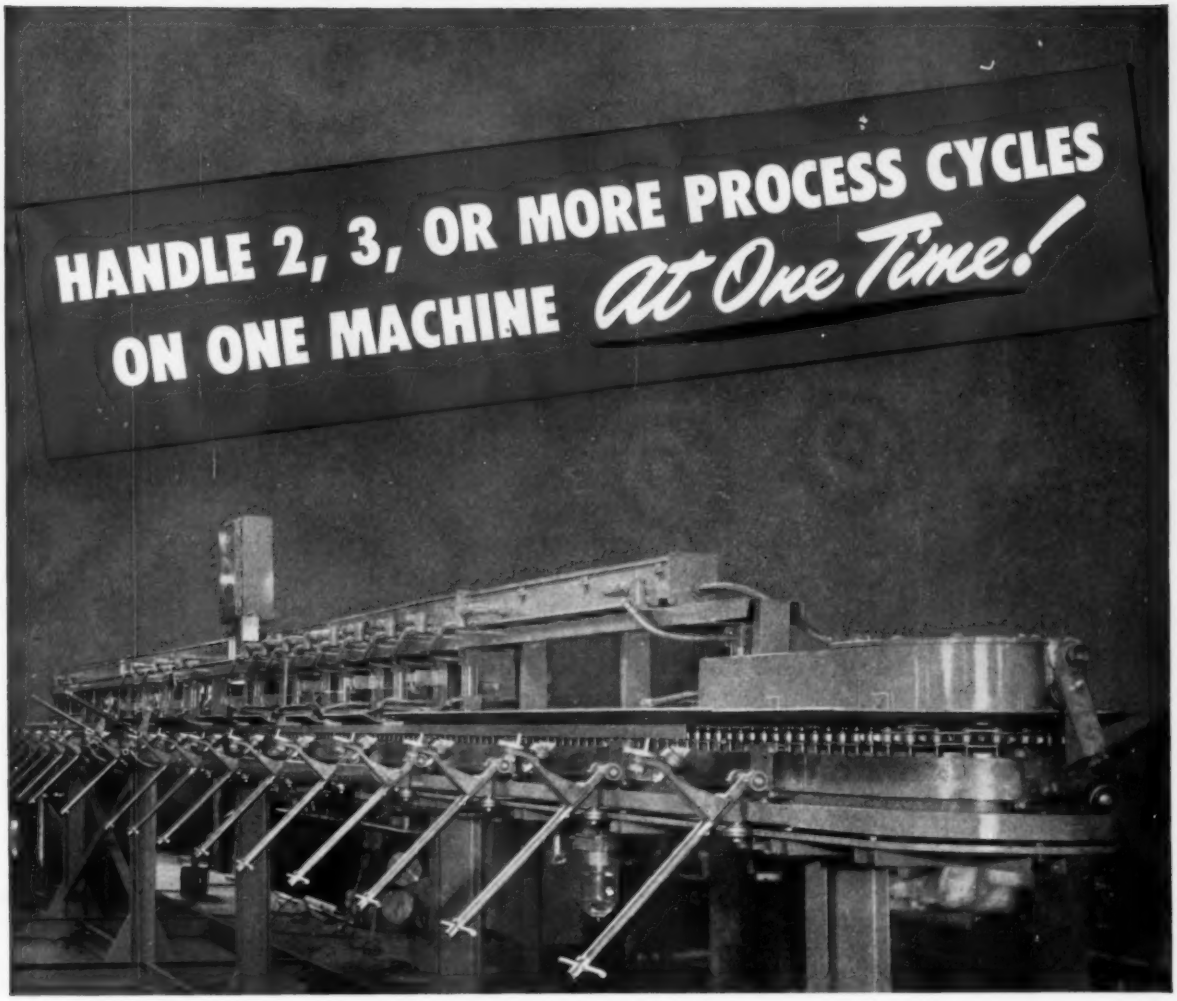
Chicago Office: 7001 North Clark St.



LASALCO'S *Select-O-Matic*

MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

See the Select-O-Matic in Action
at the Convention—Booths 327A and 330A

LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
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It gives us pleasure to announce

McCOY'S *new*

#23-11 ORGANIC PROCESS

for Leveling Bright Cyanide Copper Plating

#23-11 produces BRILLIANT MIRROR LIKE DEPOSITS from 0 to 100 ASF.

#23-11 produces MICRO-LEVELING WITHOUT CURRENT MANIPULATION.

#23-11 is a SINGLE BRIGHTENER ADDITION solution—easy to control—economical.

#23-11 uses our NON-FOAMING WETTING AGENT*—even in air agitated solutions.

#23-11 may be purified of ORGANIC or METALLIC CONTAMINATION such as chromium, selenium, sulphur or zinc by simply adding SP* (special purifier).

#23-11 with our EXCLUSIVE ANODE material ELECTROSOLV* gives "electro-polished" anodes with remarkable freedom from roughness.

#23-11 is a PROVEN PRODUCTION PROCESS with millions of ampere hour plating experience.

#23-11 contains NO VERSENES or CHELATING MATERIALS which interfere with chromium removal or copper removal in waste water treatment systems.

#23-11 is sold and serviced by qualified men in your area.

*U. S. and foreign patents applied for.

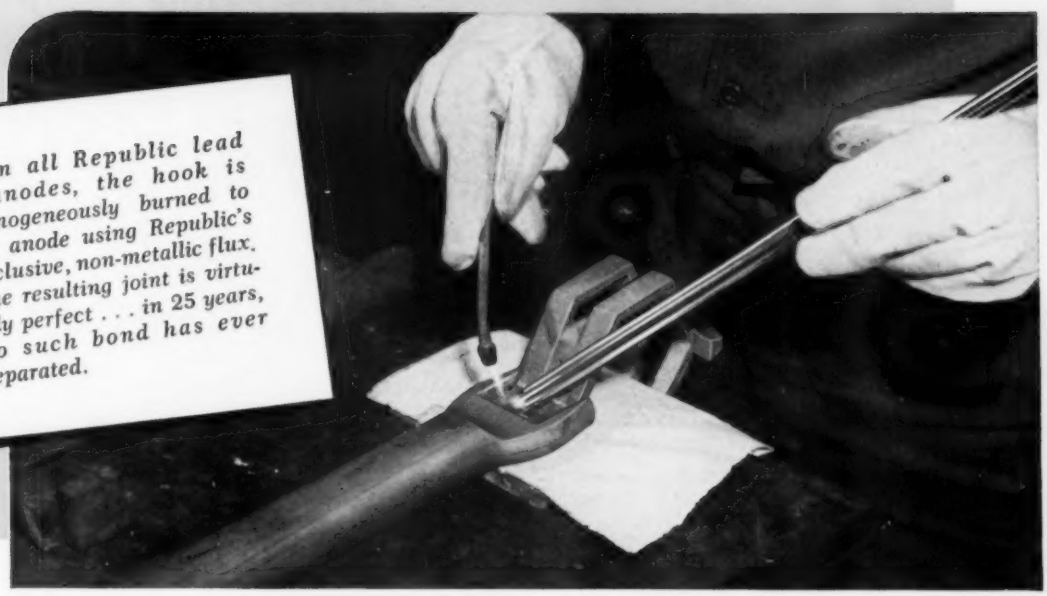
Write for operating manual and service organization in your area.

ELECTROCHEMICAL PRODUCTS, Inc.

1760 Alverno, Brookfield, Wisconsin telephone Milwaukee Sunset 6-7130

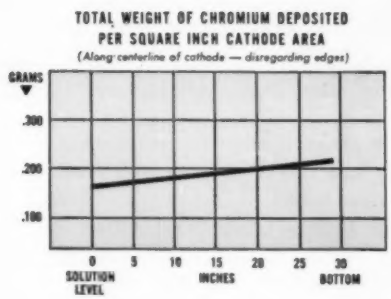
SORRY WE'RE NOT EXHIBITING AT DETROIT—WE'RE TOO BUSY!

With *Republic* HOLLOW Round Lead Anodes*...



* *In all Republic lead anodes, the hook is homogeneously burned to the anode using Republic's exclusive, non-metallic flux. The resulting joint is virtually perfect . . . in 25 years, no such bond has ever separated.*

chromium platers get full, even current distribution . . . from top to bottom!



VISIT BOOTHS 297B-298A
INDUSTRIAL FINISHING
EXPOSITION

ATTENTION REGULAR USERS OF REPUBLIC LEAD ANODES:

Get additional savings! Let us remelt and analyze your scrap anodes. After adding tin or antimony to restore the original alloy, we will extrude anodes to meet your specifications, furnished, of course, with homogeneously bonded hooks.

Laboratory tests clearly show that current flow is evenly distributed through the entire length of a Republic hollow round lead anode. What's more, this efficient current carrying capacity will remain virtually unchanged throughout prolonged use, because Republic's exclusive homogeneous bonding technique maintains positive electrical contact between hook and anode for the full life of the anode. This means maximum operating economy for the user, as well as better quality work.

Though Republic hollow round anodes provide the same plating efficiency as solid round lead anodes, their lighter weight means appreciable savings in shipping costs and easier handling in your plant, as well as savings up to 25% and more in price.

Get complete information on Republic hollow round lead anodes for chromium plating. Write for your free copy of Bulletin RA-7 . . . today!

1711-A

Republic **LEAD EQUIPMENT CO.**
7930 JONES ROAD • CLEVELAND, OHIO

A UNIT OF THE U. S. STONEWARE CO.

"SWING-BOLT" *Fulflo* FILTER CUTS YOUR PLATING COSTS

Now . . . the new Fulflo Rubber-Lined Steel Filter for plating cuts your filter maintenance costs in half, while providing tank turnover up to 3 times per hour.

New swing-bolt cover simplifies and speeds up changing elements. Just loosen the bolts, swing them out of the way, and lift off the cover to provide complete access to the patented Honeycomb Filter Tubes. Tubes are completely changed in a matter of minutes.

New bottom outlet allows for quick, easy cleaning of entire vessel simply by addition of a "T" connection with drain valve. You save time and labor.

Best of all, new engineering and production refinements enable us to offer this filter at an even lower price than the previous model.

The new Fulflo Rubber-Lined Steel Filter is offered in six sizes, with from 6 to 60 Honeycomb Filter Tubes, for capacities up to 18,000 gph. Steel or stainless steel containers are also available.

It will pay you to look into this new Fulflo Filter to improve plating quality at lower cost.

For qualified engineering advice, or new technical literature, write to Department PL

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

for mirror-bright gold and rhodium plating

ATOMEX® is a 24k gold immersion solution that permits the deposition of a thin, dense, uniform layer of 24k gold on printed circuits, trophies, costume jewelry, lamp components, clock assemblies, photograph frames, bottle caps, radio knobs, metallized plastics and many other objects, by means of a simple bath. The Atomex procedure is more permanent and less expensive than electroplating of comparable thickness. Costly analytical control is unnecessary.

RHODIUM Plating Solution . . . is ideal for putting a decorative finish on many types of jewelry, and for electrical and electronic applications. It has a hard, brilliant white, non-tarnishable, highly reflective surface and is extremely resistant to corrosion. It gives greater sales appeal to any jewelry on which it is used. A complete line of Rhodium plating solutions are available.

CHEMICAL DIVISION • 113 ASTOR STREET
NEWARK, N. J.

a simplified mirror-bright silver plating process

Here is the most efficient, simple procedure to produce mirror-bright silver plate, finished directly—through a complete range from flash to heavy deposit. It is being used with outstanding success for all types of jewelry and hollow ware. The procedure is easy, economical and non-critical—with little or no polishing required. Silva-Brite is a clear, water-white solution, enabling the operator to observe work as it is being plated. Uniformly good results are attained with current densities ranging from 10 to 40 amperes per square foot. Normal room temperature operation minimizes fumes and tendency toward bath decomposition. Send for descriptive data together with detailed plating procedures.

AMERICAN PLATINUM & SILVER DIVISION
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UDYLITE
...to make your 1959
*in Detroit—the Statler Hilton Hotel

AT THE CONVENTION...

BE OUR GUEST! We invite you to join us as we resume two pleasant Udylite customs that have become AES Convention traditions over the past few years. You are most cordially invited to be our guests at Udylite's headquarters in the Statler Hilton Hotel and at Udylite plants in the Detroit area. We have arranged an entertainment schedule of which we trust you'll fully avail yourself during the Convention in Detroit, June 15 through 19.

THE UDYLITE HOSPITALITY CENTER. We look forward to seeing you for cocktails in the Michigan Room of the Statler Hilton on Monday, Tuesday and Thursday, June 15, 16 and 18 from four to six p.m. Sparkling entertainment will feature the two outstanding personalities of Jeanne Darr and Elena Santa.

Jeanne Darr, singing comedienne

Elena Santa, beauty keyed to music

THE UDYLITE—AES BALL

Carrying on another happy Udylite tradition, you are promised a memorable night's entertainment when we welcome you to the beautiful Terrace Room of the Statler Hilton. Detroit's most outstanding musical entertainment will be afforded by the nationally famous Singing Schoolteachers, the Fenby-Carr band.

The Terrace Room of the Statler Hilton in Detroit

The Fenby-Carr band, Detroit's famous Singing Schoolteachers

If you would make your 1959 AES Convention trip a complete success, you will not fail to join us for all four functions on the three days that highlight the Udylite social calendar. We look forward to seeing you.

world's largest plating supplier

GOES ALL OUT!
Convention* memorable

...Detroit Artillery Armory, June 15 thru June 19

AT THE EXPOSITION...

Be Sure to see the most fascinating and unusual display in the whole show, Udylite's unique presentation of its entire operation. And we really mean *unique;* nothing like this has ever been seen at any convention. You're sure to want to stop in at this first-time-anywhere exhibit every time you visit the Exposition Hall. AND there are some very special surprises waiting for you when you get there. Here also you will have an unparalleled opportunity to:

SEE Plating Automation in Operation . . . Udylite's sensational new V.I.P. single control conveyor.

SEE The Udylite Cyclemaster . . . greatest advance in fully automatic plating equipment today in action.

SEE The full story behind Udylite's vast million dollar research and experimental program at work for you.

SEE The complex Udylite electrical manufacturing assembly line producing a wide range of Udylite developed equipment.

SEE The Miracles of Project Alert in the revitalization of worn and obsolete equipment to save countless dollars for you.

SEE The whole Udylite production story . . . A specialized approach to the many problems of metal finishing.

Whatever else you do, DO NOT miss this unique Udylite presentation of the finest and most complete Research, Engineering and Manufacturing Facilities. Be sure to visit us during the convention June 15 thru 19.

the **udylite** corporation

detroit 11, michigan

Now—from Allied Research

—a new systems concept for the finishing of metals.

Process Engineering Service

The first—and only—service built around the most important part of your operations . . . your process requirements.

Why a PROCESS Engineering Service?

Allied Research's long and broad experience in helping customers solve process and equipment problems of all types has led to one important conclusion:

Only by integrating equipment with your particular process are you assured of getting these important benefits from your operations: (1) higher production, (2) greater efficiency, (3) lower operating costs, (4) consistent product quality.

Our success in helping our many customers reach these important objectives has prompted us to offer this unique service to the entire metal finishing industry.

What does our Process Engineering Service consist of?

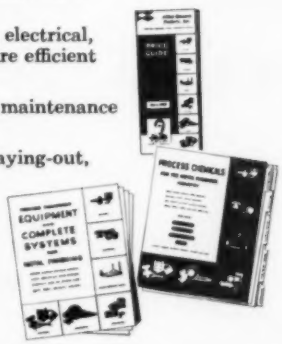
CONSULTATION—Experienced representatives will assist you in properly planning any part of or all your process and equipment requirements.

RECOMMENDATION—Trained engineers will recommend the particular process, equipment and chemicals to provide you with the best in operating efficiency and economy for your specific production requirements.

INSTALLATION—Planned, engineered and supervised—including plumbing, electrical, ventilation and disposal requirements—or whatever else is needed to assure efficient and proper operations.

SERVICE—Field Engineers insure proper start-up and will make necessary maintenance recommendations. They are available for periodic check-up.

"TURN-KEY" Service—let Allied Research take complete responsibility for laying-out, designing, building, installing and servicing your complete process operations. *Open the door to your plant and start production.*



Get the complete details on Process Engineering Service today. Call your Allied Field Engineer. He's listed under "Plating Supplies and Equipment" in the yellow pages. FREE TECHNICAL DATA FILES on Allied Research processes, equipment and chemicals sent on request.

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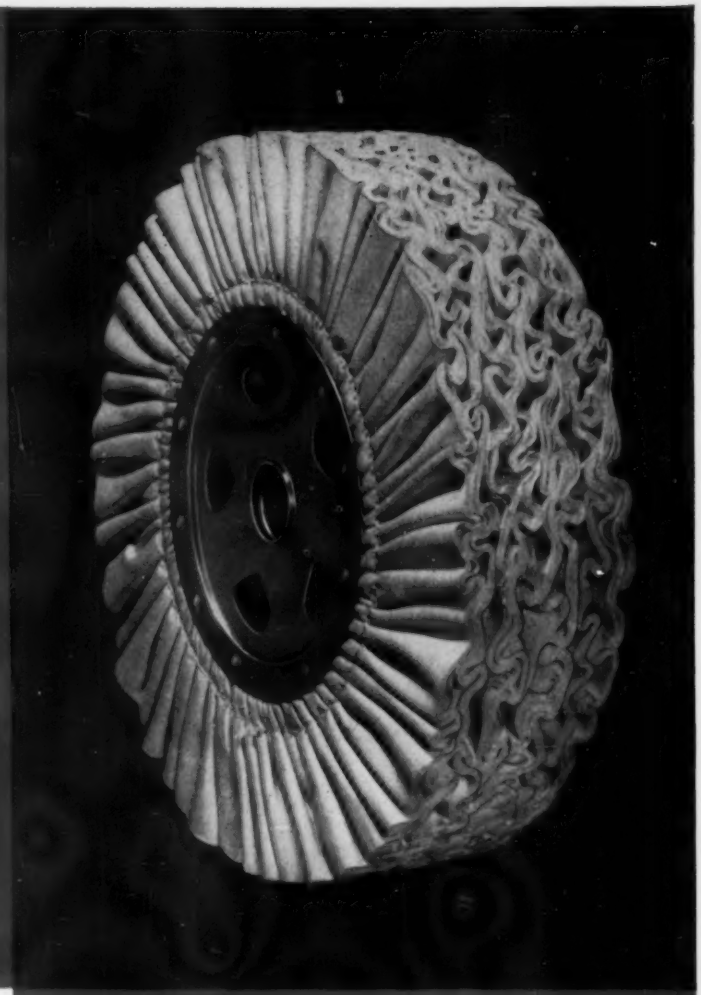
IRIDITE® Chromate Coatings | IRILAC™ Clear Coatings | ISOBRITE® Plating Brighteners | ARP® Chemicals & Supplies | WAGNER Line of Equipment

WILLIAMSVILLE BUFF DIVISION
EST 1893 A1 ®
DANIELSON CONNECTICUT

NOW for Automatic Buffing



LET THE FAMOUS Williamsville CUTMASTER

- Precision-engineered for perfect balance throughout
- Perforated steel center gives cool running at highest speeds
- Cut on the bias for extra life
- High-count long fibre cotton will not fray or ravel

GIVE YOU LONGER SERVICE ... GREATER PROTECTION!

For over half a century, Williamsville Buffs have boosted production — cut overhead costs — in plants all over the country. Ask us for the answer to your buffing problems now — write, wire or phone!

WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON • CONNECTICUT

Your NATIONAL TRADE MARK brush man showed this electroplater how to double brush life!

CLIFF BROWER

Rapid brush wear was limiting generator performance at this busy electroplating plant, says "National" Carbon Brush Man, Cliff Brower. No other industrial brush solved the problem until Cliff suggested a newly developed "National" brush grade.

That was five years ago. Since then not one commutator has been stoned or turned. Brush wear has been even, with no selective action or overheating—even under 20% overloads. This "National" BGX brush grade actually doubled brush life.

Cliff Brower and his fellow "National" Carbon Brush Men have been solving industrial brush problems for years. Their experience and training—backed by "National" *long term brush development*—make them the best consultants on any industrial brush problem.

Call your "National" Brush Man today. Or write National Carbon Company, Division of Union Carbide Corporation, 30 E. 42nd St., New York 17, N. Y.

UNION CARBIDE

The terms "National", "N" and Shield Device, and "Union Carbide" are registered trade-marks of Union Carbide Corporation

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INDICATE A 625. ➤

M&T DEVELOPMENTS MEAN PLATING PROGRESS...AND MORE EFFICIENT OPERATIONS

The AES and M&T have always had something in common—besides fifty years of close association. Both have worked to advance the state of the art to the benefit of all.

With one of the finest and largest laboratories devoted to electrochemical research...with an intimate knowledge of what the industry needs and wants...M&T aims to keep up a constant flow of improvements for better plating at a better profit.

What M&T has already achieved is briefly indicated by the products and processes in the following pages.

PROCESSES

MATERIALS

EQUIPMENT

look ahead
...stay ahead
with
Finishing
Processes

UNICHROME SRHS® CHROMIUM PROCESSES

SRHS Chromium

When introduced, this process marked the first big breakthrough in chromium plating. It plates up to 80% faster than ordinary chromium. It self-regulates important constituents of the bath to maintain optimum plating balance... simplifying control. It has wider bright plate range, excels for plating chromium on chromium or stainless steel.

Industrial Crack-Free Chromium

This process provides a ductile, matte deposit free from corrosion-admitting cracks. It also has excellent resistance to impact, abrasion, and thermal shock, opening new applications for the plater where ordinary chromium falls short.

Bright Crack-Free Chromium

This new type of chromium offers a highly significant improvement over ordinary chromium for many bright plating applications. It is free from microscopic cracks inherent in ordinary chromium deposits... giving much greater corrosion protection. Covering and throwing power are also superior.

COPPER PLATING PROCESSES

M&T Bright Cyanide Copper

This advanced process plates mirror bright deposits if desired. It permits use of high current densities for fast plating without burned edges. Stability of its addition agents gives greater freedom from decomposition difficulties... assures economy, easy control.

Unichrome Pyrophosphate Copper

Most widely known for smooth and exceptionally dense deposits, this process proves especially useful in engineering-type plating applications, such as on printed circuits, computers, and electroforming; also for impervious masking or stop-off in nitriding and carburizing applications.

M&T Bronze

This practical and easy-to-control process deposits an alloy plate, usually 88% copper and 12% tin. Resembling 24K gold in color, M&T Bronze offers an unusually attractive final finish. As an undercoat, it surpasses copper on corrosion resistance. It also plates much faster with exceptional throwing power.

TIN AND TIN ALLOY PROCESSES

M&T High Speed Tin

The M&T High Speed Potassium Stannate Process is suited to a wide variety of still and automatic work, and especially to barrel plating. This High Speed Bath is preferred over sodium baths for many applications. It permits higher current densities with high cathode efficiency maintained. Solubility of the salts is better, and the solution is more stable and has higher conductivity.

M&T Sodium Stannate Tin Plating

This process, too, gives the advantages of an alkaline bath, such as simplicity of makeup and control, suitability of plain steel equipment, wide operating range and excellent throwing power.

Immersion Tinning

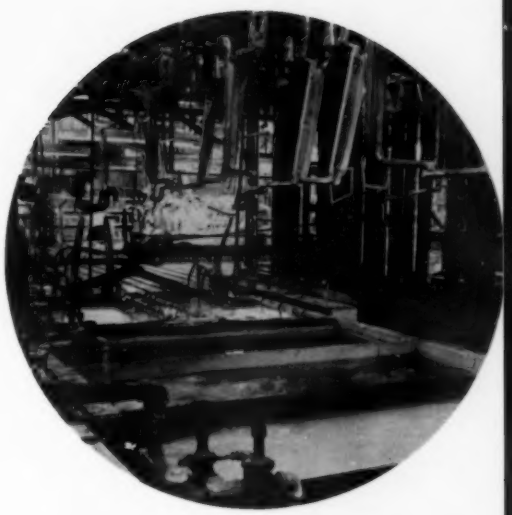
M&T Potassium Stannate serves for immersion tinning of bronze, copper and brass. Other M&T chemicals, including Stannochlor® (anhydrous stannous chloride), are available for immersion plating of copper, steel and aluminum.

M&T Tin Zinc

Permits production of deposits of various ratios, with 78% tin and 22% zinc generally being the most useful; assures excellent corrosion resistance plus easy solderability for electrical products.

M&T Tin Nickel

This process deposits alloy of 65% tin, 35% nickel. Plate is attractive in appearance, highly resistant to corrosion, highly resistant to tarnishing. It can be deposited directly on most basis metals, by still tank, automatic or barrel plating methods.



CHROMATE TREATING

Unichrome Dips

M&T has developed one of the widest lines of these chromate conversion coatings available for zinc and cadmium. It includes materials for chemically producing chromium-like clears, yellow, brass, olive and black colors, as well as a new group of red, blue, green and gold dyed finishes. Unichrome Dip Finishes offer good resistance to salt spray and exposure tests, meeting Government and other specifications. They give eye appeal and corrosion protection at low cost.

Anozinc®

This exclusive M&T process converts zinc plate by anodic treatment. It produces black, clear or yellow chromate conversion coatings. Finishes are tougher than those produced chemically, and can be handled while wet. The Anozinc cycle uses conventional equipment. The solution has unusually long life and low cost operation.

M&T MATERIALS ... *developed to fill plating plant needs*

Unichrome Coating 218X

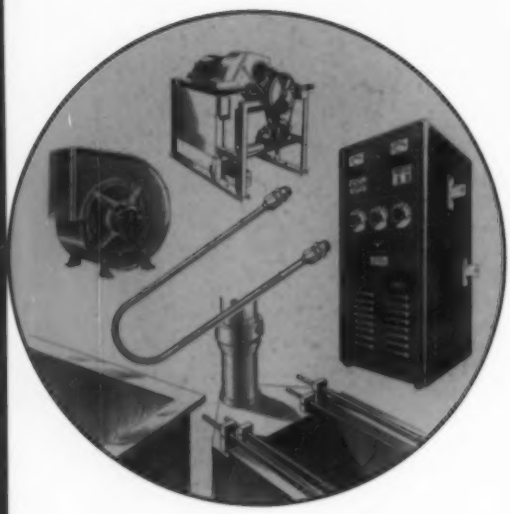
Platers have been saving maintenance money for a decade with this top quality rack coating. It has a built-in cure indicator, is approved for the most sensitive baths, can be rebaked for patching.

Unichrome "Super 5300" Plastisol

This sprayable vinyl plastisol costs less to apply than sheet lining, gives seamless protection. On tank interiors, it seals solidly against corrosion; on exteriors, it gives a "lifetime" coating.

Neochel®

This recent M&T development improves all cyanide copper and bronze baths. It increases cathode and anode efficiency, cuts cyanide consumption, smooths the deposits, minimizes effect of contaminants. Platers report it outperforms any other additive.



Other Special-performance Products

UNICHROME STOP-OFF MATERIALS (lacquers, waxes, tape) suit any method of application, any shape of work, any plating cycle.

UNICHROME "RESIST" MATERIALS include rigid shapes for structural use in tanks; and flexible tape and tubing for insulation.

UNICHROME STRIPPERS will speedily, safely remove electrodeposits from rejects.

M&T EQUIPMENT... *engineered to save on operating costs*

Unichrome Rectifiers

These DC sources are built to specifications of M&T engineers who know plating plant requirements intimately. They feature the best in diode materials, and the finest in circuitry and components. Available in any type, any capacity and with any control, for satisfying the plating or anodizing load with minimum expenditure.

Chromium Plating Barrels

M&T has to its credit the development of the first successful barrels for chromium plating. A *continuous* plating type handles up to 200 pounds of parts per hour. A Unichrome Barrel for *batch* plating is also available. Both types plate high quality chromium that shows no contact marks. They turn plating of small parts into a practical and profitable operation.

Anodes

Essential to the plating process, anodes have shared in M&T research efforts. The cylindrical lead-alloy anode for chromium plating was originated by M&T and is now available in ribbed or smooth round design. For tin plating, M&T "High Speed" (pat.) Tin Anodes operate at high current densities. M&T also supplies anodes for zinc, copper, nickel and cadmium plating.

Tantalum Equipment

Introduced by M&T, UNICHROME HEATING COILS of acidproof tantalum have proved their ability to increase efficiency, reduce maintenance and downtime, cut costs.

UNICHROME HEAT EXCHANGERS use tantalum tubes on the acid solution side, for the same advantages.

Other Equipment

M&T also supplies still tanks, temperature controllers, ventilating fans, cathode agitators, moisture extractors, and other specially engineered equipment. Information and quotations on request.

Detailed literature and technical information is available. Remember that technical service accompanies all M&T processes and products. It is given willingly. It is plating-minded. It is supported by long experience in the field.

a name synonymous with research, progress and cooperation in metal finishing...

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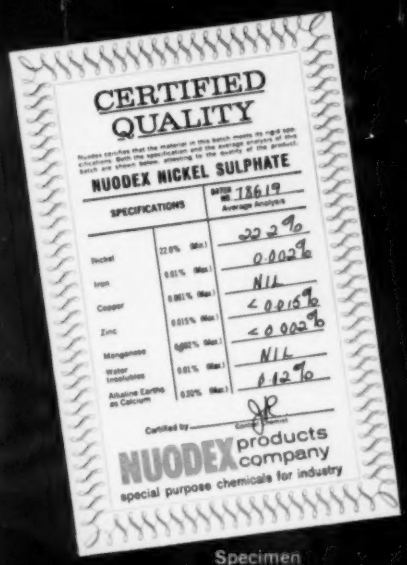
The most important benefit in plating today


CERTIFIED QUALITY

NUODEX NICKEL SULPHATE

SPECIFICATIONS		Batch No. 13619 Average Analysis
Nickel	22.0% (Min.)	22.2%
Iron	0.01% (Max.)	0.002%
Copper	0.001% (Max.)	NIL
Zinc	0.015% (Max.)	< 0.001%
Manganese	0.002% (Max.)	< 0.002%
Water Insolubles	0.01% (Max.)	NIL
Alkaline Earths as Calcium	0.20% (Max.)	0.12%

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NUODEX products company
special purpose chemicals for industry

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Every package of Nuodex Nickel Plating Chemicals bears a signed certificate with complete specifications and exact analysis. There's no doubt about it. Only Nuodex gives you this assurance of consistent high quality and purity. Buy the best . . . it costs no more.

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Service

Technical service with a capital S

. . . yours when you specify and use Diamond Chromic Acid

You get the latest facts on all phases of chromic acid application, research and testing. Facts that can help you lick a production problem, quality problem, or research problem.

One such fact—DIAMOND CPA 1800 is *the additive* for chrome plating which increases plating speed, expands tank capacity, improves throwing power and the metallurgical character of chromium plate.

For top-quality plating get DIAMOND CHROMIC ACID and DIAMOND CPA 1800 *plus* all the facts from your Diamond Representative or your nearby Diamond Distributor. They can supply DIAMOND CHROMIC ACID where and when you need it. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

THE

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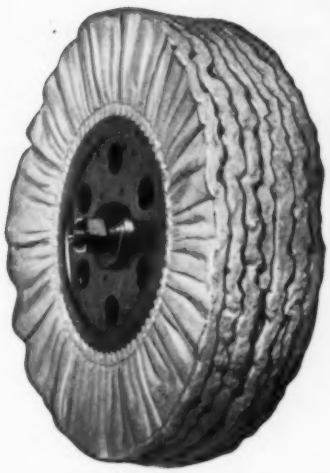
61 YEARS OF FINISHING KNOW HOW

A RELIANCE PRODUCT FOR EVERY FINISHING REQUIREMENT

KUL-KUT BIAS BUFFS



Particularly adaptable to semi and full automatic operation

Fully ventilated for coolest operation

Removable or permanent centers— for interchangeability

Various types of cloth in every diameter, pucker & ply

For any application

RELIANCE SISAL BUFFS

For that tough cutting down job on steel or stainless steel

We manufacture a complete line of buffs, and whether it be bias, pieced or full disc type; cloth or Sisal— there is a Reliance Buff designed and constructed to handle every buffing requirement with the greatest efficiency and economy.

RELIANCE POLISHING & BUFFING COMPOSITIONS

EXTRUDED • MOLDED • LIQUID

They cut—They clean—They color—

For all metals and plastics, and for every buffing speed

Our Field Engineers are ready to help you with your polishing or buffing problem—They have the 'know how', the buff, and, the compound to produce a quality job— FASTER, AND MORE ECONOMICAL. Why not call one in today? You will be glad you did.

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The "Plus" of General Plate RHODIUM PLATING SOLUTIONS Customer Service

CUSTOMER SERVICE IN THESE AREAS:

- Analytical service for electroplating bath control
- Testing — results furnished promptly
- Competent consultant staff and comprehensive laboratory facilities
- Complete refinery to reclaim contaminated solutions

General Plate Rhodium Plating Solutions are produced under strict laboratory control assuring the highest quality and purity of product. Quantities from 5 grams up of both sulphate and phosphate type solutions are supplied from stock in the new unbreakable, transparent containers.

General Plate Solutions from Metals & Controls have been described by long-time platers of jewelry and decorative items as producing the most brilliant finish they've ever experienced. For applications requiring protection against corrosion and tarnish, and for uses where the mechanical properties and adherence to the base metal are of primary importance, General Plate Solutions give unexcelled results . . . and they cost no more.

If you're looking for Rhodium Plating Solutions *and service* from your supplier, look to Metals & Controls. Technical assistance is yours for the asking . . . no obligation, of course.

Bulletins PLA-4 and PLA-11 give complete information.

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A DIVISION OF TEXAS INSTRUMENTS INCORPORATED

GENERAL PLATE PRODUCTS: Clad Metals • Electrical Contacts • Truflex® Thermostat Metal • Platinum Metals • Reactor Metals • Radio Tube & Transistor Metals

It's a matter of leadership

AMERICAN ELECTROPLATERS' SOCIETY

50 years of it for the A · E · S ·

Any organization can feel justly proud of such a long-standing service record—especially when it's filled with magnificent achievements. We know—like the A.E.S., Oakite is also celebrating 50 years of service to the electroplating industry.

50 years of it for Oakite, too

Oakite started the same year as the American Electroplaters Society. Our objective then: better cleaning at lower unit cost. Policy today: the same.

But today, more than 160 cleaning materials, over 250 field service men, and a 50-year wealth of plating experience are at your service.

You get "plus" factors to help you reduce cleaning costs. There's the personal help of a nearby cleaning specialist . . . latest information on modern materials . . . modern methods . . . unsurpassed research facilities devoted to constant improvement in the chemistry of cleaning. Results are guaranteed. Write for technical bulletins that give details. Oakite Products, Inc., 40 Rector St., New York 6, N. Y.

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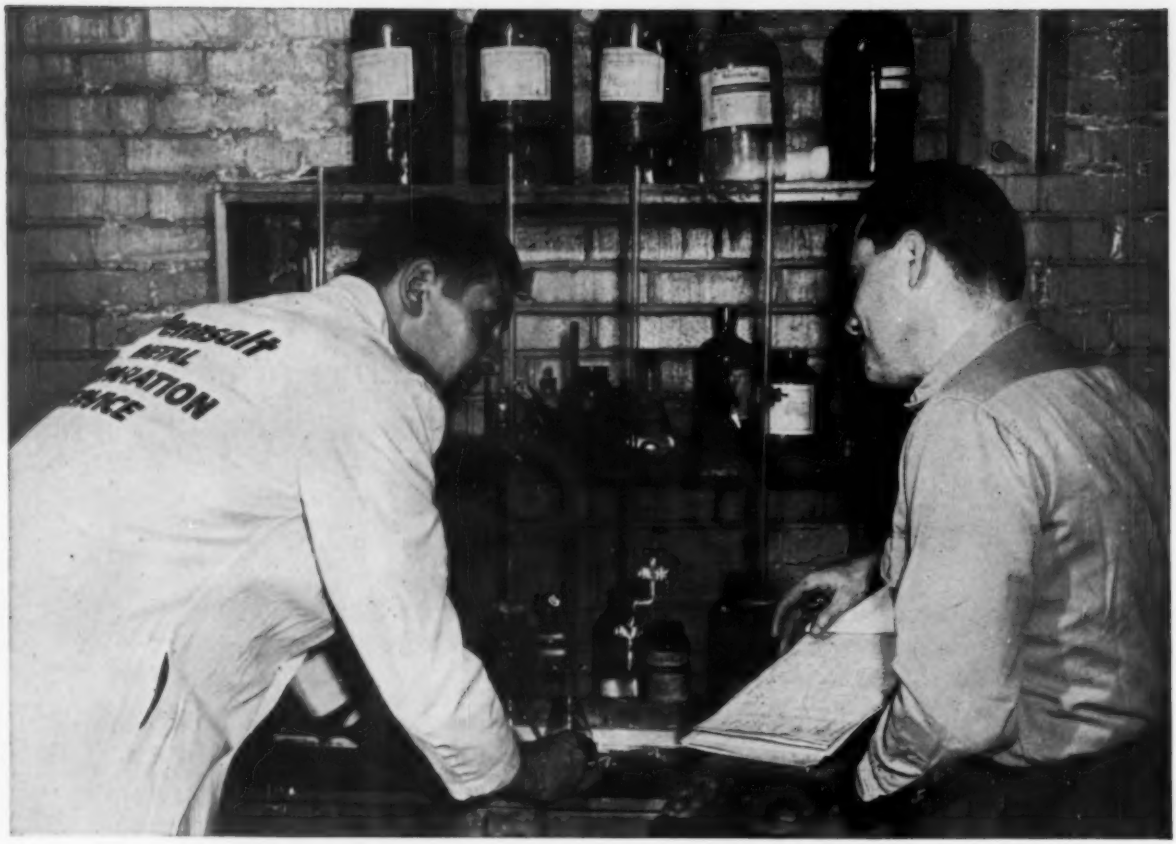
50 1909-1959 SCIENCE
years' leadership in industrial cleaning



Pennsalt PLANNED SERVICE

helps you get higher efficiency, economy, quality

for **"a better start for your finish®"**

Pennsalt's Metal Preparation Service Plan gives you complete, personalized service by a nation-wide staff of trained specialists. You get periodic surveys of your processes . . . help in modernizing with automatic equipment . . . installation and start-up aid . . . laboratory analyses of your special problems . . . fast emergency service . . . plus other important aids to better finishing.

Service like this . . . exclusive from Pennsalt . . . is another way you profit from Pennsalt's "system approach" to metal surface preparation. Pennsalt supplies a complete line of quality processing compounds, and a plant-proved line of automatic surface treating machines . . . integrates chemicals, machines and service to help you get superior finishing with top economy.

SEE US AT THE INDUSTRIAL FINISHING EXPOSITION, BOOTH 7C

Write Today

for your copy of this booklet on Pennsalt's Metal Preparation Service Plan, or see your Pennsalt representative for more information on Pennsalt service, materials or machines. Write to Dept. 207.

METAL PROCESSING DEPARTMENT

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The New BELKE
beautiful & economical
Plating Barrels
for 1959

Completely submerged cylinder operation

Low level superstructure — added clearance for safe transfer of cylinders

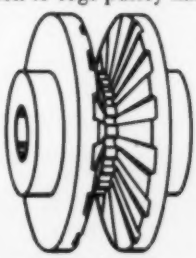
One piece 3/4" diameter copper cathode cable with heavy rubber insulation

New hanger design of amazing simplicity and beauty

Completely covered with black pastisol. Can be washed clear and clean with a hose in seconds.

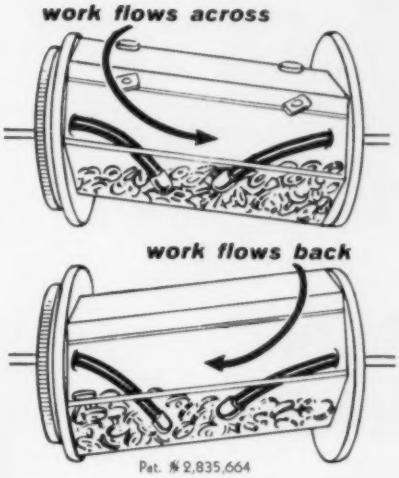
Non-skid V-Belt Pulley

Gives greatly increased belt traction. In addition to cogs pulley has non-skid tapered cleats on both sides. Wrap and tension expand the belt into the spaces between cleats, thereby adding tremendously to traction afforded by the notched belt meshed with the cogs.

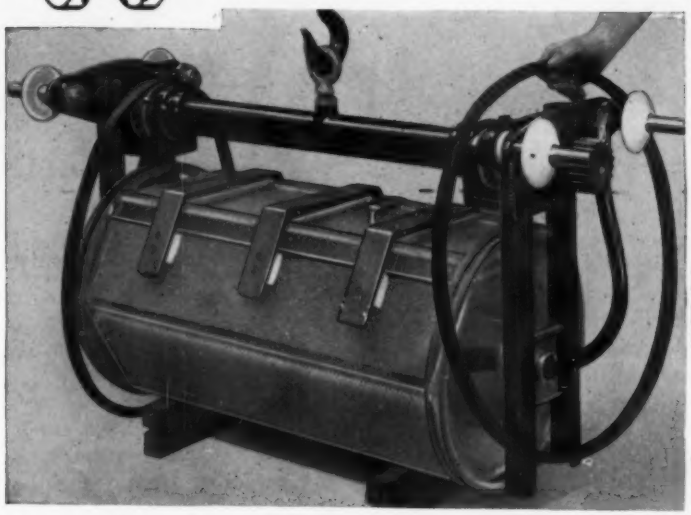


BELKE Double Oscillating Cylinders sweep the nation

Rock and Roll produces specified thickness in less time



Pat. # 2,835,664



INSTANT BELT and CYLINDER CHANGE

Lower cylinder on blocks. Lift off belt—put on belt. Lift out cylinder—put in cylinder.—bing, bang done—tool time, zero.

Available with Double Oscillating Cylinders

The 1959 Plating Barrels can be furnished with hanger mounted motor drive.

Heavy duty, long life and low upkeep construction

- Long life, thick wall Teflon bearings
- Hanger guides covered with hard sheet rubber
- One piece hanger bridge completely plastisol coated
- Solid copper saddle-horns with heavy solid copper bar connection to cathode cable
- Uses notched V-BELTS and multiple grip pulley for tremendously increased traction

Conventional cylinders are available in Plexiglas, Melamine, Bakelite, Transite, Tempron Hard Rubber. BELKE Double Oscillating Cylinders are available made of Plexiglas.

Whatever your requirements for plating room equipment, send specifications or write.

Belke Manufacturing Company
947 N Cicero Ave., Chicago 51
EVERYTHING FOR PLATING PLANTS

Imperial's Plant Superintendent, left, and Wyandotte Representative Emil Haas examine frames cleaned with BUFSOL.

MARIANO RANNO

"Bufsol removes hard, tenacious buffing compound"

— says Mariano Ranno, secretary-treasurer, Imperial Plating Co., Brooklyn, N.Y.

"Wyandotte BUFSOL has proved itself a real performer in our plant," states Mr. Ranno.

"We use it to remove a hard, tenacious buffing compound from polished-steel hand-bag frames — items we plate in large volume. These frames must meet exacting quality standards for jewelry-type nickel and brass plating.

"BUFSOL has reduced our over-all cleaning costs, thanks to its effectiveness under difficult conditions. And the Wyandotte representative has worked closely with us to help effect these savings."

* * *

All-soluble Wyandotte BUFSOL removes buffing compound *without solvents*. It's fast, safe, effective, and adaptable to every plating cycle.

BUFSOL liquid detergent concentrate assures bright, stain-free, adherent electrodeposits. And BUFSOL is safe on all metals, essentially odorless and will not contaminate your plating bath.

For full information and a demonstration of BUFSOL and other Wyandotte metal-cleaning products, call your Wyandotte representative today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California, and Atlanta, Georgia. Offices in principal cities.*

Wyandotte CHEMICALS

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THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

increase your business by offering customers Kanigen®

Stainless Steel Reactor Tube Bundle—
Inside of tubes, outside of tube sheet and hub Kanigen plated to reduce the danger of stress corrosion cracking.

More and more jobs are specifying Kanigen, the chemical nickel alloy coating. You can bid on these jobs in one of three ways:

a) by requesting estimates from General American.
b) by contacting a Kanigen licensee.
c) by setting up your own Kanigen plating operation under license from General American.

With Kanigen, you are freed of many of the restrictions of electroplating. Kanigen has no throwing power limitations and will not "burn" metals. You are assured of a hard, uniform surface on complex shapes in the desired thickness. Vessels up to 20,000 gallons in capacity can be Kanigen coated or simple rack, jig or barrel coating is available. The Kanigen process will fit in with most existing facilities for metal preparation prior to plating.

If you'd like more information about Kanigen, call or write. You'll find, *it pays to plan with General American.*

World's largest production facilities (plants at: East Chicago, Ind.; Sharon, Pa.; Compton, Cal.) for chemical nickel alloy plating on

Iron
Copper
Aluminum
Titanium
and their alloys

Pilot plant facilities are available for nickel alloy chemical plating on magnesium, beryllium, uranium and non-metallics including thermosetting plastics, glass, ceramics.

KANIGEN is a trademark which identifies chemical nickel coating by General American Transportation Corporation and its licensees, the product resulting therefrom and compositions produced by them for use in chemical nickel coating.

Write for Technical Bulletin #258

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GENERAL AMERICAN TRANSPORTATION CORPORATION
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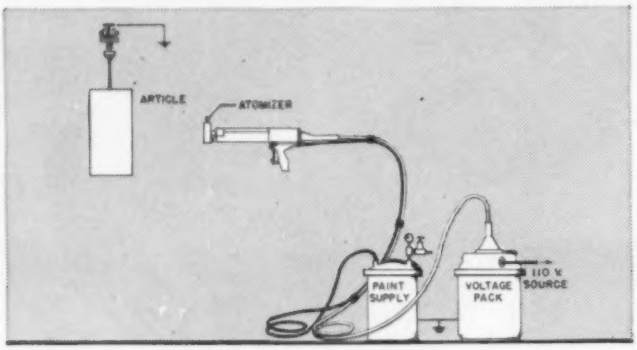
Here it is—

The PAINTING TOOL ALL Industry has been waiting for!

The NEW

RANSBURG

NO. 2 PROCESS ELECTROSTATIC HAND GUN



CUTS PAINTING COSTS!

Saves Paint because there's no waste. Now, for the first time, the high efficiency of Ransburg's No. 2 Process automatic equipment is available to you in the NEW Electrostatic Hand Gun.

Saves Labor, Increases Production because it is faster on many types of articles such as those fabricated from perforated and expanded metals, tubing, rod and wire. This is due to the "wrap-around" nature of electro-spray which paints ALL sides of such articles from one side only.

Saves in Equipment because no conventional spray booth is required—no water-wash, no sludge recovery! Uses no compressed air for atomization.

Saves Building Heat Loss because only mild ventilation for removal of solvent vapors is necessary, and . . .

Maintenance Costs Are Cut because clean-up and maintenance labor is only a fraction of that required by other, less efficient painting methods.

See how YOU can save in your own finishing department, and at the same time, improve the quality of the work. Write for literature and information showing how the Electrostatic Hand Gun has been proven on different products in a variety of industrial plants.

Call or write

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AES

GOLDEN JUBILEE EXPOSITION

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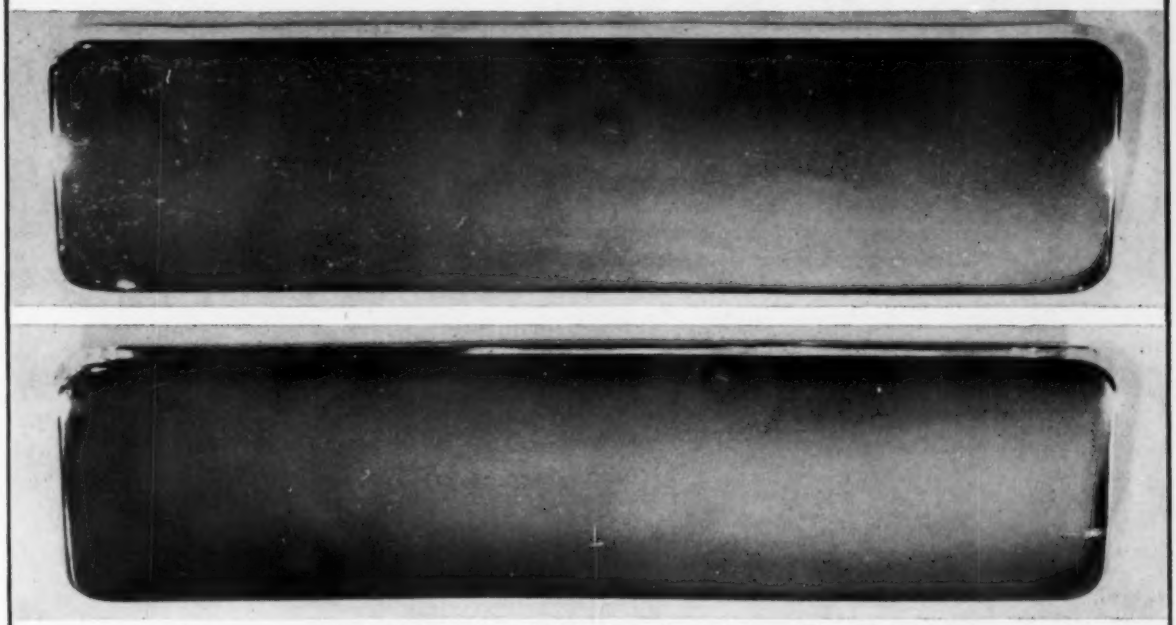

These unretouched photos show plated zinc die-cast bars. *Top Photo:* Plating defects are visible on a bar precleaned with a conventional soak cleaner. *Bottom Photo:* Note the bright, lustrous, defect-free plate of the bar precleaned with Kelite SUPERSOLV as the soak cleaner.

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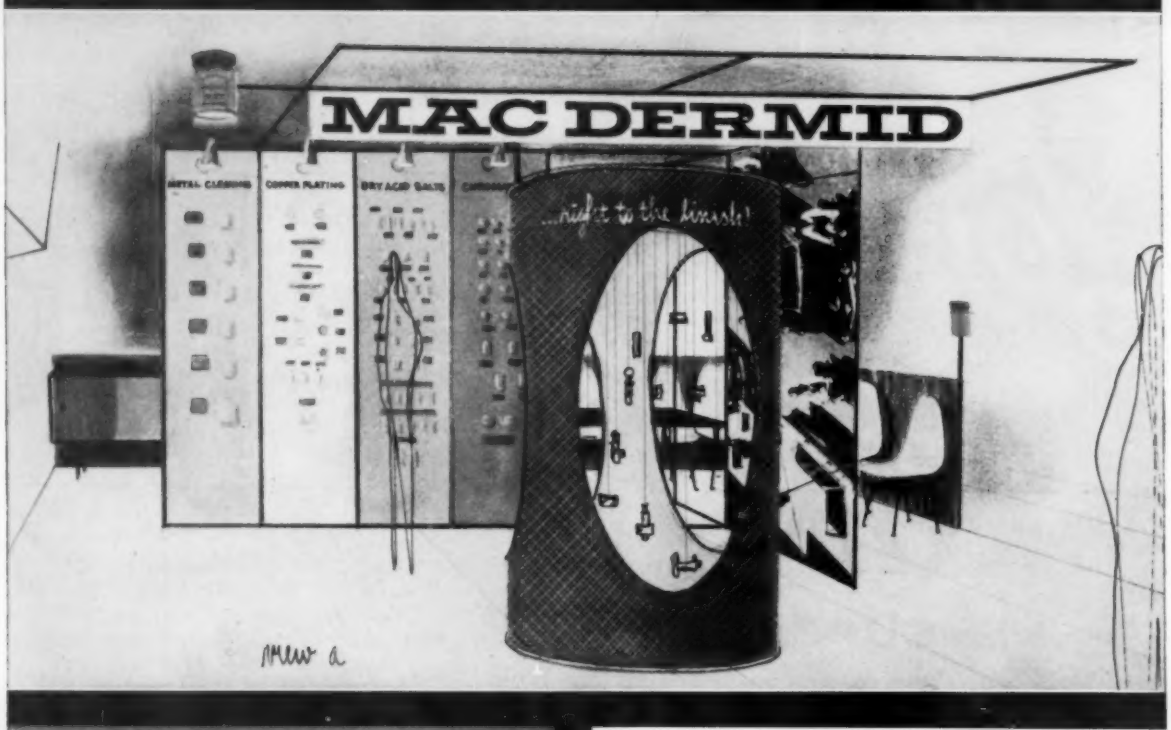
PURIFICATION OF CYANIDE PLATING SOLUTIONS



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THE STORY OF NICKEL PLATING

by GEORGE DUBPERNELL*

It is not commonly realized that nickel plating was discovered at Harvard University, about 100 years ago. It is also not appreciated that working out the first commercial process required ten years of intermittent effort on the part of Isaac Adams Jr., and came as the climax to a long period of struggle and disappointment, after innumerable tests and failures, tragedies and minor successes.[1]

Isaac Adams Jr. was born in Boston February 20, 1836. His mother died a few years later, and he attended boarding schools during much of his adolescence. His father invented the Adams Printing Press a few years before the birth of Isaac Jr., and the manufacture and sale of these first successful power printing presses soon made the family wealthy.

Young Isaac was a good student, and his father intended that he should become a doctor. After his graduation from Bowdoin College in Brunswick, Maine, in 1858, he attended the Harvard Medical School where he received his MD degree in 1862. During this period he studied under Josiah Parsons Cooke, professor of mineralogy and chemistry, and during the years 1858 to 1860 he investigated the electrolytic possibilities of many nickel and cobalt salts, and made some electrotypes of these metals about 3 in. by 4 in. by 0.003 to 0.005 in. thick.[2] Some samples made in 1860 were given to Professor Cooke, who placed them in his cabinet (reference 1, page 98).

Upon graduating from Harvard Medical School in 1862, young Isaac went to Paris to continue his studies at the École de Médicine until the fall of 1864. During this period he studied "mostly chemistry", and became proficient in glass blowing,[3] in addition to advanced medical studies. He was also said to have studied under Professor Bunsen in Germany.[4]

When he returned to the United States in the Fall of 1864, Dr. Adams immediately set up for the practice of medicine at 763 Federal Street, Boston, and lived with his brother Aquila at 43 Chester Square. He apparently failed to build up a good medical practice for one reason or another, perhaps because of his other activities. He established a laboratory in South Boston for work in chemistry and physics, and from 1865 to 1868 he put his knowledge of glass blowing to practical use by making a large number of Geissler tubes of various sizes and designs, which he sold to E. S. Richie of Boston, Chester Bros. of New York City, and Professor Cooke of Harvard University (reference 3, page 2686).

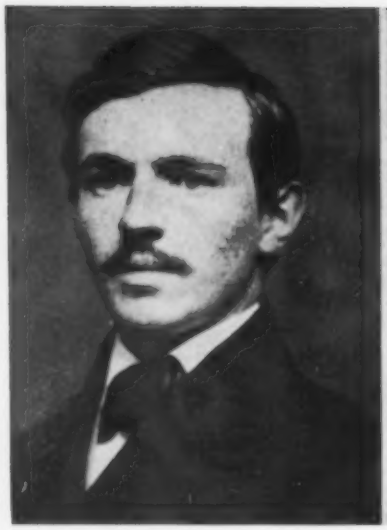
At this time he also made a number of vacuum tube, "carbon burner" incandescent lamps, more than ten years before Edison. His electric light was essentially identical to Edison's with the exception that he did not develop a high voltage carbon filament, but instead used a thin "slip" of carbon lighted by a low voltage. Not visualizing any cheap source of electric power, he decided not to attempt the electric lighting business.

Dr. Adams became engaged to his cousin, Elizabeth Agry Adams, of Norridgewock, Maine, in the latter part of 1864, but she was the ward of his father's brother and business partner, Seth Adams. Uncle Seth was violently opposed to the marriage, and wrote to Elizabeth on February 23, 1865: "He is now about twenty-nine years of age and up to this time his record of life is entirely what it ought not to be. He has never earned one cent towards his support and he is in no business that he manages in such a way that gives any evidence that he is likely to." Elizabeth became ill during 1865, and died at Uncle Seth's house in Newton, Mass., August 1, 1866. This must have been a great shock and tragedy to Dr. Adams, and perhaps influenced his decision a year or two later to give up the practice of medicine.

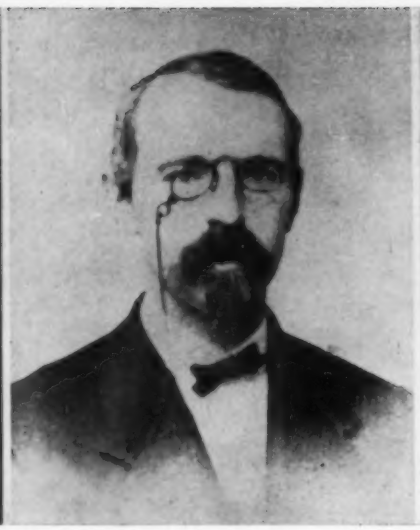
Toward the end of 1865 Dr. Adams was approached by Joseph Smith of Boston, a dealer in gas fixtures, and asked to furnish a substitute for the Lava gas-tip. He worked on it for several months, when it occurred to him that a nickel plated iron tip might serve. Mr. Smith gave him some financial backing to set up about a twenty gallon nickel solution, and perhaps also to file a patent application. In Dr. Adams' own words (reference 1, pages 99 to 100):

"I commenced nickel-plating gas tips, I think, in the spring of 1866, but was not particularly successful, although I used, or supposed I used, a plating solution similar in its composition to the one I had used in 1860. I attempted, at that time, with the same solution, to produce an electrotype of nickel similar to the one I had given to Professor Cooke, and failed. The nature of the deposit which I produced was probably not such as to reassure Mr. Smith, or to give him a favorable impression as to the practicability of the process. However that may be, as far as he was concerned, he allowed the thing to drop there. The patent was issued to me soon after. I undertook, at that time, to nickel-plate a lot of corset-clasps and a patent finger-guard, but the nickel deposit which I produced was not suited in quality to the purpose, and I was compelled to abandon its application to those articles. I afterwards silver-plated the finger-guards to the number of about fifty thousand. This failure to produce what I had already produced six years before, namely, a reguline deposit of nickel, led me to experiment further, to determine the reasons why I succeeded in the one case and failed in the other. In experimenting with the commercial nickel which was to be had in the market of that day, I found that certain substances existing there had to be removed, or their effect in some way neutralized. The information obtainable from the books on this subject was exceedingly meagre, and I found that I had to commence at the bottom and to determine experimentally the effects produced upon the nickel deposit due to the presence of the substances alluded to above; these were notably zinc, arsenic, copper and iron. This was not all. I found that the presence of the salts of the fixed alkalies and alkaline earths in certain solutions would have to be excluded or their decomposition prevented, as otherwise, owing to the facility with which such salts are decomposed, secondary products, non-metallic, would make their appearance upon

* Technical Advisor, Metal & Thermit Corporation, Detroit 20, Michigan



Isaac Adams Jr., Bowdoin 1858

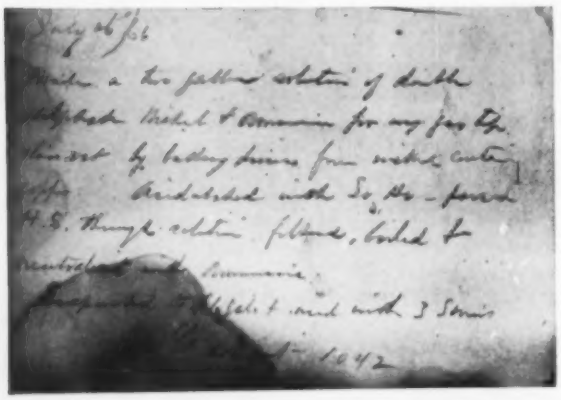


Dr. Isaac Adams Jr.

Mrs. Isaac Adams Jr.

the cathode and injure or ruin the deposit. Further than this I found that the presence of any free acid produced an evolution of hydrogen, lessening the quantity of metal on the cathode, and that the presence of free ammonia, or more properly speaking, an alkaline state of the solution, tended to hinder or prevent the dissolving of the anode. It was only when I had fully completed these experiments that I considered I had such knowledge of the properties of the solution as to enable me to successfully nickel-plate as a business, or to impart such knowledge as would enable another person to produce a successful deposit. The experiments and discoveries to which I have just referred were completed in the winter of 1867–8."

Dr. Adams goes on to describe his work on the production of cast nickel anodes from 1859 to 1868, including the effect of carbon and silica to make the nickel easier to melt, and concludes: " . . . I found that the addition of a certain amount of iron (to the anodes) would practically prevent the deposition of copper and arsenic. The experiments, methods and directions, both as to solutions and anodes, were completed in the winter of 1867–8—they were perfected and reduced to practice at that time."



Original record of an early experiment from Dr. Adams' Notebook No. 1.

"July 26, 1866

Made a two gallon solution of double sulfate of nickel and ammonia or my gas tip gloss vat by battery process from nickel containing copper. Acidulated with SO_4HO—passed H_2S. through solution, filtered, boiled and neutralized with ammonia.

Evaporated to 1½ gal. & tried with 3 Smee's
Sp. Gr. about 1.042

(bad as before)"

The patent on nickel plating gas tips was filed July 16, 1866, and issued on August 21, 1866.[5] Dr. Adams stated that he plated more than 100 gross of the iron tips, but the business failed to grow because the lava tips were more profitable.

In the early part of 1867, Dr. Adams went to Europe with his brother Aquila and J. E. Thatcher. One purpose of the trip was to consider the commercial possibilities of incandescent lamps with A. Gaiffe, an instrument maker in Paris who later became his French backer for the sale of nickel plating (reference 3, pages 2689–2690).

The next effort to commercialize nickel plating was made by William H. Remington of Boston late in 1868. Mr. Remington was convinced that nickel could not be cast into anodes, and his patent[6] related to an anode basket of platinum wire to contain the cube nickel of the day; and to a carbon plate covering the bottom of the tank and connected as anode, onto which the nickel grains or cubes were dumped. Another feature claimed was electroformed nickel anodes. The solution was made by dissolving nickel in nitric acid, precipitating nickel carbonate with potassium carbonate, filtering and washing, dissolving in a strong solution of sal ammoniac (ammonium chloride), and filtering. According to Dr. Adams, the solution was dark blue due to addition of excess ammonia, the same as the prior solutions of Boettger[8] and Becquerel,[9, 10] thus making proper dissolving of nickel anodes impossible. Remington apparently plated some good samples and received some good publicity,[7] but was unable to stay in operation due to lack of knowledge of the need for a neutral or slightly acid solution, among other things.

Remington's financial backer became frightened at the continued expense and called in Moses G. Farmer, a famous electrician of the day. Mr. Farmer in turn had Dr. Adams called in, in March, 1869 to straighten matters out at the shop at 14 Province Street, Boston. This was done during the next two months. The shop was finally reorganized with Dr. Adams in charge and called The Boston Nickel Plating Co. It moved to 13 Bowker Street in 1872, and to 160 Port-

West 25th Street with an office at 18 Park Place connected

land Street, where it is still in business, about 1876 or 1878.

Some of the small nickel cubes shovelled out of Remington's tanks when the solutions were discarded are still in the possession of Mr. James Campbell of the Boston Nickel Plating Co. The International Nickel Company, Inc., analyzed two of these cubes with the following result:

copper	4.76 per cent
iron	0.85 per cent
carbon	0.28 per cent
silicon	0.18 per cent
sulfur	0.12 per cent
manganese	0.05 per cent max.

The percentage of copper above is eloquent of one of the difficulties of those times. Present specifications call for not over 0.10 per cent copper in nickel anodes, and 0.02 per cent maximum copper in nickel salts.[11, 12]

Two patents were filed by Dr. Adams May 6, 1869 and issued May 25, 1869. One covered a sulfite solution for nickel plating[13] said to be advantageous when the anodes were contaminated with zinc; and the other related to combining nickel with silica or carbon, or both, in order to make it more fusible and get better castings.[14]

The United Nickel Company was incorporated in New York on June 14, 1869 by E. A. Quintard, George D. Allen, Charles C. Beaman, Jr., J. Trumbull Smith and Joseph Hayes, with capital stock of $1,000,000. The original trustees included William E. Learned of New York and Isaac Adams Jr. of Boston, in addition to the above five persons (reference

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1st--It is much whiter than any other Nickel deposit.
2d--It is flexible and more adhesive.
3d--Its durability exceeds that of silver.
4th--Its brilliancy is equal to and more permanent than polished silver.
5th--It produces a coating of any desired thickness, which will stand BENDING, TWISTING, HAMMERING, RIVETING OR CUTTING, WITHOUT BLISTERING OR PEELING.

Which is Not the Case with any other Process,

Making it applicable for all kinds of Machinery, Instruments, Lock Work, Fire Sets, Plumbers' Work, and in fact every article of manufacture where metals are used. Iron, both Wrought and Cast, Steel, Copper, Brass, German Silver, Bronze, White Metal and Britannia of any size or shape, can be successfully plated by this process.

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224 Elm Street, CINCINNATI, OHIO.

A competitive process

Nickel cubes from Remington's tank

1, pages 37–38). Dr. Adams owned about 10 per cent of the stock and served as president, chemist, and patent advisor until the company was dissolved in 1890.

The main patent on the Adams process of nickel plating was filed July 9, 1869 and issued August 3, 1869.[15] It describes the purification of nickel and of its salts, and the production of nickel sulfate. This is then converted to nickel ammonium sulfate (double salts) by combining with the requisite quantity of ammonium sulfate. The bath was made up to 1.5 to 2.0 oz/gal nickel concentration, and should be neutral with the avoidance of strong acidity. The preparation of the double chloride of nickel and ammonium is also described, but the use of sulfate baths is preferred.

The production of nickel anodes is also described. Nonmetallic impurities are removed as slag when the nickel is melted, and zinc is volatilized. Sufficient iron is added to the molten metal to be the chemical equivalent of the copper and arsenic present, and keeps them from interfering with the plating process.

Four precautions are given for good results:

1. Do not use too high a current density.
2. Keep potash, soda, or nitric acid from being dragged into the solution.
3. Use an anode area somewhat larger than the cathode, especially with the sulfate solution.
4. In plating zinc articles, plate them with copper first.

Electroforming is described and claimed as well as electroplating. The principal claim states that the nickel solution should be " . . . free from the presence of potash, soda, alumina, lime, or nitric acid, or from any acid or alkaline reaction."

Another patent application was signed by Dr. Adams on October 7, 1869 and filed November 5, 1869.[16] It had the title "Process For Protecting, Hardening and Beautifying Various Metallic Articles", and enumerated most of the more important uses of nickel plating at the time. While the final fee was paid November 11, 1869, the application was rejected November 20th. On December 9, 1869 it was amended by cancelling all except the last paragraph and substituting an entirely new specification on plating gun parts only! This was granted, and issued on December 21, 1869.

Along with the formation of the United Nickel Company, a job shop was started in New York City in July, 1869, having larger capacity than the Boston shop. It was called the New York Nickel Plating Company and was located at 133 to 135

West 25th Street with an office at 18 Park Place connected with the office of Greene, Tweed & Co. The new nickel plating became popular immediately, and business was good. Some records available indicate that the New York Nickel Plating Company did a business ranging from $4000 to $8000 per month in 1874 and 1875, in spite of the depression of 1873–1878.

Shortly after signing the last patent application above on October 7, 1869, Dr. Adams went to Europe with Mr. Quintard to establish the nickel plating industry there. A small experimental shop was started in Liverpool almost immediately, and a larger plant of about 600 gallons capacity in Birmingham by the spring of 1870. A similar plant was opened for business in Paris in December, 1869, under the management of A. Gaiffe.

Dr. Adams mentions that they had no competition at first, and that it came later on.[2] However, it was not very much later, as his English backer, Alfred Sellers of Sheffield, wrote him on May 1, 1872: "Verily! friend Adams thou hast stirred up the deep waters of Nickel plating by the long pole of thy patents and now everyone, either knew of it before or can now do it better than thou canst." The influence of competition can frequently be seen in the numerous patent suits which followed, and even in the nature of some of the patents taken out.

Two more American patents were filed while Dr. Adams was abroad. Both were signed in London February 1, 1870. One[17] covered the use of three other double salts of nickel

Bronze medal awarded at the International Industrial Exhibition in Buffalo, New York. This medal was apparently nickel plated by Dr. Adams and has remained bright and untarnished in its case for 88 years.

Picture printed from a nickel electrotype made in Paris in March, 1870.

sulfate, nickel aluminum sulfate, nickel potassium sulfate, and nickel magnesium sulfate. These solutions are preferably used at temperatures over 100F, and freedom from any acid or alkaline reaction was emphasized especially. The other patent related to the production of nickel anodes with better solubility characteristics by adding carbon to them.[18]

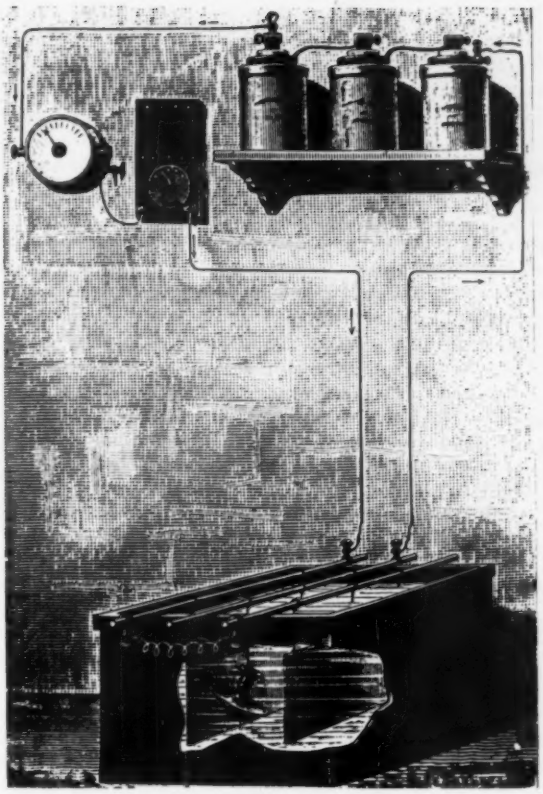
Aside from his activities in selling and establishing nickel plating in England, France, Germany, and Austria, it appears likely that Dr. Adams married in December 1869, although one source[19] indicates December 1868. He married Lucille Emilie, daughter of George Lods of Hericourt, France, and associated in some way with his French backer, A. Gaiffe.

The story is told that arrangements were almost completed for a large contract for nickel plating guns for the French Army, when the Franco-Prussian war broke out in July 1870, and broke up the negotiations. At any rate, it appears that Dr. Adams probably returned to the United States in about August 1870.

Another patent application was filed December 19, 1870, claiming merely a cast nickel anode as a new article of manufacture.[20] Two other applications were filed October 8, 1870,[21, 22] but due to an interference were not granted until July 4, 1871. That of Moses G. Farmer[21] related to the production of nickel plating solution or double salts by electrolyzing a solution of ammonium sulfate with a nickel anode "by the battery process", while that of Dr. Adams[22] covered the same process using a hot solution.

It is usually assumed that the Adams process consisted in

The vigorous enforcement of the nickel plating patents would seem to have left something of a "psychic scar" on the



An early plating tank set up for plating with batteries as the source of power. From Roseleur, sixth edition, page 136, 1892.

the use of a solution of pure double salts alone. This is not true. The record shows that Dr. Adams commonly made a pure solution of single nickel sulfate, and added the desired quantity of ammonium sulfate, but less than that required to form double salts with all of the single salt. He was aware that it was frequently desirable to maintain a somewhat higher nickel concentration than afforded by pure double salts, particularly at low temperatures, and generally employed some of both.

A patent application was filed January 17, 1873, on plating with single salt baths.[23] This reiterated the greater need for purity with single salts, and the poor anode solubility if the solution became alkaline. It was found that the single salts " . . . can be successfully used . . .", and such use was claimed.

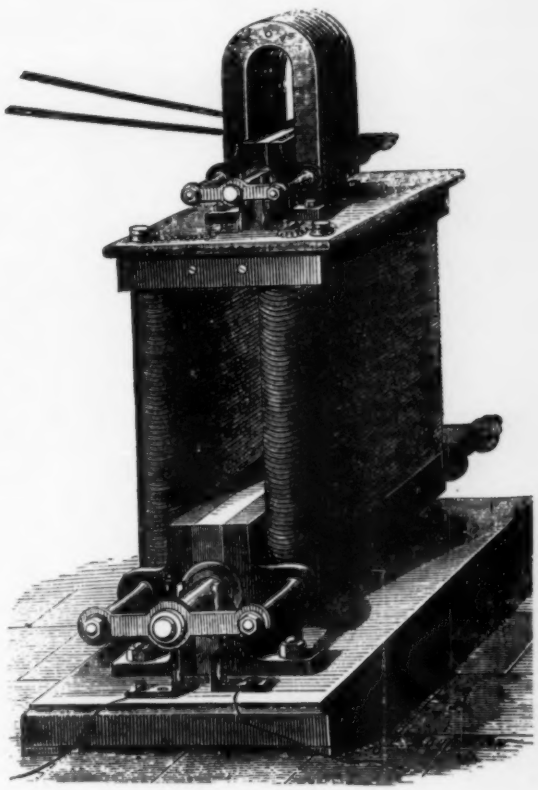
Dr. Adams' last patent on nickel plating was filed October 21, 1872, but did not issue until August 25, 1874,[24] probably due to an interference with H. T. Brownell.[25] This patent related to heating nickel plated articles at a low red heat (about 700F) to improve the adhesion for more severe service. Brownell's patent[26] related to heating the article before nickel plating, and then plating in a hot bath.

The still later patents are of lesser interest to us. One on cobalt plating claimed the use of various double salts of cobalt, and also disclosed a method of making cobalt anodes.[26] Another related to bonding rubber to clothes wringer rollers by means of the use of a cyanide copper plate,[27] and is understood to have been assigned to the Hood Rubber Company. The last patent related to the electric light bulb work, and covered especially the use of a lead glass composition for sealing platinum lead in wires.[28]

Aside from job shops in Boston and New York, and numerous licensees, a job shop was also started in South Windham, Connecticut, in January 1872, called The Adams Nickel Plating and Mfg. Co. Dr. Adams was president, and part of the business was the plating of screen plates for paper pulp for the Smith & Winchester Company. A patent was granted on this use of nickel plate.[29] The shop also manufactured and sold nickel plated screws; and served as a headquarters for the United Nickel Company, in addition to the offices in Boston and New York.

The United Nickel Company defended its position against all infringers promptly and energetically from 1871 to 1886. This was necessary if it was to survive. The times were those of the "robber barons" in American industry. The trade fought the patentees at every turn, and used every device to outwit them. Dr. Adams testified in 1890 (reference 3, page 2706), . . . "We carried on very extensive litigation in ten or twelve different states of the Union, and brought hundreds of suits—quite a number of them to final hearing. We had, all told, first and last over a thousand licencees . . . ".

Some of the more important decisions in the patent suits are readily available,[30–40] in addition to the complete record in the Weston suit. In many cases the effect of contamination with potassium, sodium, aluminum and calcium salts was argued rather endlessly, but the most important fact was that the baths should be free from any acid or alkaline reaction. At the time in question the only measure of acidity and alka-



Wilde dynamo for generating electricity for plating. The New York Nickel Plating Company was said to have the only one of these machines in this country in the early 1870's. They were characterized by two armatures, the smaller one on top being used for excitation. Photo from Wahl, page 96, 1883.

Baker patented[52] a mixed indicator of one part brom thymol

unbagged anodes were satisfactory if the air agitation was

Former factory of the Adams Nickel Plating and Mfg. Co. in South Windham, Connecticut as it appeared in 1954.

linity was by titration, a rather inadequate method for the purpose of controlling nickel baths.

The suits were partly decided on the fact that there was no commercial process of nickel plating before Adams, and the success of his process was taken as a strong indication of the validity of his patents. Even the addition of a small amount of tartrate,[31] or of a larger amount of acetate and acetic acid[36] was held to infringe.

Dr. Adams in 1888 in the kitchen doorway of his home in Annisquam, Mass.

The vigorous enforcement of the nickel plating patents would seem to have left something of a "psychic scar" on the plating industry, or at any rate there has sometimes been a substantial aversion to paying royalties on new metal finishing processes. The royalty rates of the United Nickel Company were given[41] as 3¢/gal/mo. on 100 gallons of solution, and graded down to 2¢/gal/mo. for larger installations.[42]

It may be of interest to know what was considered a good job of decorative nickel plating in those days. A. Gaiffe published an article[43] in which he stated that a nickel deposit of 1 gram per square decimeter was generally considered satisfactory, and cost about 10 centimes (about $0.02, or about $0.20 per sq ft). This would be a nickel plate about 0.0005 in. thick.

After the patent suits ended and the United Nickel Company was disbanded in 1890, Dr. Adams retired from business and lived in a summer home at Annisquam, Mass., with a winter residence in Cambridge, Mass. He became a rather little-known figure by the time of his death, July 24, 1911, and only a few obituary notices have been found.[44]

THE USE OF BORIC ACID

Edward Weston was born in England May 9, 1850. Like Dr. Adams he was trained for medicine; but coming from a poor family, it was by means of a three-year apprenticeship to a doctor in Wolverhampton. He rebelled against a medical career and sought employment at the Royal Institution in London, but failed to make any connection. Due to a chance acquaintance he resolved to come to America, and arrived in New York as a young man of 20 in May 1870, a year after Dr. Adams had successfully established his nickel plating process.[45]

Weston soon became an expert at nickel plating, but did not succeed in finding a way to avoid infringing Dr. Adams' patents. He did improve the nickel baths by adding boric acid to them, and patented this addition.[46] Boric acid was not widely used at first, and it is mentioned (reference 45, page 54) that competitors used acetic acid to avoid infringement. The patent ran out in 1895, but it was many years later before the dependable action of boric acid as a mild brightener and as a buffer in the acid range, made it an almost universal constituent of nickel baths.

Langbein, in 1898 gave ten formulas for nickel baths with only one containing 4 oz/gal of boric acid.[47] W. Pfanhauser senior and W. Pfanhauser junior[48] gave five formulas for nickel baths in 1900, and used 2.67 oz/gal of boric acid in two of them. A. Brochet in 1908 did not include boric acid in his formulas, but favored the use of this chemical (reference 49, pages 242 and 245).

In 1911, E. S. Sperry[50, 51] investigated the use of boric acid in nickel baths and stated that its value had only been appreciated for the previous five years. Earlier workers were criticized if they used more than ⅛ to ¼ oz/gal. Sperry found that the solubility of boric acid in nickel baths at room temperature was about 6 oz/gal, and recommended this concentration. The lack of greater solubility provided a simple means of control, since an excess would not dissolve, and too low a concentration was not very serious.

Nevertheless, the analysis of nickel baths for boric acid has received considerable investigation. Wogrinz and Kittel[52] proposed the removal of all nickel from the sample by electrolysis, and titration of the boric acid after adding glycerine or mannitol. Citrates do not interfere as they are destroyed at the platinum anode.

Baker patented[53] a mixed indicator of one part brom thymol blue to five parts brom cresol purple for the direct titration of boric acid in single salt solutions, after the addition of glycerine or mannitol. The writer used this indicator in plant control and obtained good results with it. It is still in use, and recommended in several textbooks.

Phenolphthalein can be used for this end point if the nickel solution contains a salt which will prevent the precipitation of nickel hydroxide at about *p*H 7. Willard and Ashworth suggested[54] the use of brom thymol blue alone, as it changes color at *p*H 7. They also suggested neutralizing the green color of the nickel salt by adding a red dye, fuchsine.

Willard and Ashworth especially point out the interference of ammonium salts, fluorides and citrates, if these are present, and give methods for their removal or avoiding the interference. The same problem is attacked by more recent workers. Vincke[55] suggested the removal of nickel by electrolysis before the determination. Raub, Bihlmaier and Nann[56] also depend on removing the nickel by electrolysis, and study the determination in the presence of citrate.

Longfield[57] proposed a method which he felt overcame most of the interferences. He titrated the boric acid directly, with 0.02 gram of methyl red dissolved in glycerine as the indicator, and felt his results were accurate to 0.25 oz/gal of boric acid. Langford (reference 58, pages 92 to 94) complexes the nickel with sodium citrate and glycerine, and titrates to a phenolphthalein end point.

There is little standardization or agreement regarding the boric acid determination. Pfanhauser (reference 59, page 1221) advises against the determination, but also suggests a more recent direct titration based on work by A. Wogrinz and G. Kudernatsch,[60] using a brom cresol purple end point after adding invert sugar sirup. Fortunately there is not a very great need; the nickel bath can be kept saturated, or an inaccurate titration is satisfactory for control purposes.

AES Research Project No. 2 has suggested titrating to a phenolphthalein end point after removing nickel by precipitation as nickel ferrocyanide.[61] This is a good practical method for general use. A more recent suggestion[61a, 62] to remove the nickel by ion exchange is probably less convenient in most cases.

CHLORIDES AND ANODE BEHAVIOR

Bancroft (reference 2, discussion, page 218) appears to have been the first (1906) to state clearly that a small amount of chloride in a nickel bath was sufficient to ensure that the anodes would dissolve with 100 per cent efficiency regardless of their composition or structure. In the early days, Adams[15] and others used nickel ammonium chloride baths, but found the deposits somewhat dark and favored sulfate solutions. There must have been some awareness that the anodes dissolved better in chloride solutions, but this does not appear to have been explicitly discussed. Adams[15] suggested the use of an anode area somewhat larger than the cathode " . . . particularly in the sulfate solution". The common practice was to use such a low current density—only a few amperes per square foot—that the anodes dissolved satisfactorily.

Foerster[63] studied the electrodeposition of nickel with nickel anodes in 1897, but does not discuss the anode behavior quantitatively. It is probably significant that he uses slightly higher current densities with chloride than with sulfate baths. He bagged his anodes with parchment paper, but this deteriorated excessively in the chloride solutions. However, the anode sludge was more adherent with chloride baths, and unbagged anodes were satisfactory if the air agitation was placed a few inches away from them.

Langbein (reference 47, page 180) points out that baths with a good concentration of ammonium chloride will dissolve even rolled nickel anodes freely, and tend to turn alkaline in operation. Pfanhauser (reference 48, page 361) recommends a higher current density and an anode area only half that of the cathode in a solution containing chloride. According to O. P. Watts (reference 64, page 123) E. F. Kern in 1908 stated that pure nickel anodes could be used with 100 per cent efficiency if a small amount of chloride is present. A. Brochet also pointed out in 1908 (reference 49, page 244) that even a low concentration of ammonium chloride is sufficient to make nickel anodes dissolve readily.

While ammonium chloride (sal ammoniac) was used in making up some of the early baths in 1868–1869, it does not appear to have become a common constituent of nickel baths until much later. Langbein[47] in 1898 only suggests ammonium chloride in three out of ten baths, and several of these were special solutions for plating over zinc, with rolled nickel anodes specified. Langbein describes (reference 47, pages 176–177) an "American Nickel Bath" which consisted only of a 15 to 20 per cent solution of ammonium chloride used with cast nickel anodes. This bath, also called the "Nickel Bath Without Nickel Salts", of course did not work until electrolyzed sufficiently to dissolve some nickel from the anodes, and then was used primarily for thin plating on cheap articles.

Pfanhauser,[48] in 1900, recommended a bath containing 5.3 oz/gal double salts, 2.6 oz/gal boric acid and 2 oz/gal ammonium chloride. This general type of bath became the most common for several decades, frequently with the inclusion of some single nickel salts also in order to secure a higher metal content. Thus E. S. Sperry in 1911[50, 51] gave as a typical nickel bath: 8 oz/gal double salts, 1 oz/gal single salts, 1 oz/gal sal ammoniac, and up to 6 oz/gal boric acid; this formula is considered as good as any known.

Blum and Hogaboom in the 1949 edition of their book (reference 65, page 379) give the following formula for a cold solution: 16 oz/gal single salts, 2 oz/gal ammonium chloride, and 2 oz/gal boric acid. The ammonium chloride serves the double purpose of increasing anode solubility and hindering the formation of basic salts on the cathode at high current densities. Blum and Hogaboom also give a special formula for nickel electrotyping consisting of 9 oz/gal single salts and 0.7 oz/gal ammonium chloride. The use of ammonium chloride has decreased radically with the advent of bright nickel plating, as ammonium salts are frequently incompatible with the brighteners employed.

The first good modern investigation of the behavior of nickel anodes was that of Thomas and Blum.[66] Twenty different anodes were tested, and it was shown that any type of anode can be used if the bath contains some chloride. Not many additional studies of nickel anodes have been published. Several good investigations[67, 68, 69, 70] were published in full in the PROCEEDINGS. Thews reviewed the subject in 1951[71] and Bauder[72] gives an extensive bibliography of both articles and patents.

ACIDITY AND THE CONTROL OF *p*H

We have already noted that one of Dr. Adams' most important contributions was that nickel baths should be free from any acid or alkaline reaction whatsoever.[15] His pre-

BOSTON NICKEL PLATING CO., INC.
The First and Oldest Nickel Plating Company in the United States—Established 1869
"The Finest Name in Plating"
160 PORTLAND STREET
BOSTON 14, MASS.
1955
OFFICE OF
The Adams Nickel Plating & Mfg. Co.,
So. Windham, Ct. Jan. 1 1884.
Providence Nickel Plating Works,
No. 127 EDDY STREET, Prov., R. I.
LICENSED BY THE UNITED NICKEL COMPANY
Providence, R. I. Dec 14th 1871
Isaac Adams
OFFICE OF
New York Nickel Plating and Mfg Co.,
Cor. 22d Street and 2d Avenue,
NEW YORK NICKEL PLATING CO.
New York Aug 31, 1874
OFFICE OF
A. GREENLEAF & CO.
[Successors to Hanshaw & Greenleaf.]
Nickel Plating Works,
No. 167 West Lombard Street.
Baltimore, Nov 21st 1874
OFFICE OF
UNITED NICKEL COMPANY,
No. 239 BROADWAY.
New York June 8 1882
Sellers & Electro-Plate Works,
Newhall Street, Birmingham.
July 13/70
INSTRUMENTS DE PRECISION
A. GAIFFE
40, Rue St André-des-Arts, 40.
PARIS
12, Rue de l'Impératrice,
LYON.
The Plating Company Limited
London 28 Cornish Street, Strand W.C.
WORKS,
Lichfield Street,
BIRMINGHAM.
2nd March 1872
Isaac Adams Jr.
Please send a Memorandum of all articles to be plated at time of shipment.
BUSINESS OFFICE OF
UNITED NICKEL COMPANY,
13 BOWKER ST.
A. N. GLASS, Treas.
Boston, Isaac Adams Jr.
Isaac Adams, Jr., Pres.
J. S. Parsons, Treas.
F. C. Winchester, Secy.
A. J. Fobes, Agt.
Office of
The Adams Nickel Plating and Mfg. Co.,
South Windham, Conn., Oct 23d 1874.
E. A. QUINTARD & CO.,
LEHIGH, RED AND WHITE ASH, LOCUST MOUNTAIN AND CUMBERLAND COAL,
P. O. Box 1435.
E. A. QUINTARD,
W. W. SKIDDY.
No. 9 PINE STREET,
New York, August 13, 1871
Dear Doctor
ARTICLES OF ASSOCIATION
OF
The Hartford Nickel Plating Company.
Eclipse Nickel Plating Works,
111 and 113 Pine Street,
Saint Louis, Sept 10 1871
Dr Adams

Early nickel plating companies

cursors had used strongly ammoniacal solutions in which nickel anodes were insoluble, because they got no plate in acid solutions, or very poor plates generally. Dr. Adams controlled the acidity or neutrality of his solutions by keeping them neutral or slightly acid to litmus paper, and alkaline to Congo Red paper. This became the practice for a long time.

Weston's addition of boric acid buffered the bath and made it easier to operate in a favorable range of acidity.[46] Langbein (reference 47, pages 166–168, 172–173, 179–182) discusses these matters in considerable detail. He also points out the tendency of rolled nickel anodes to make nickel baths turn acid, and cast anodes to make the baths become alkaline, and suggests the use of some of each for best maintenance.

Jordis[70] suggested the neutralization of all strong acids with ammonia, and then acidifying with weakly dissociated acids such as boric acid or citric acid, in order to get the best hydrogen ion concentration. Foerster[71] studied the effect of hydrogen ion concentration on the deposition potentials of cobalt, nickel, and iron, in 1916, but had no accurate measure of the concentration, as the *p*H scale was not developed until a few years later. He found that hydrogen deposited easier than nickel or cobalt; and that in 1N and 2N nickel sulfate solution the hydrogen ion had more effect than in nickel chloride, while in 4N nickel sulfate there was less effect than in nickel chloride. Riedel[76] also varied the hydrogen ion concentration in an effort to improve the adhesion of nickel deposits from cold baths.

About 1920 the *p*H scale for measuring and indicating hydrogen ion concentrations had become well standardized in biological work,[76] and began to be used in other fields. McKay[77] and Mudge[78] state that the International Nickel Company started using it in the control of nickel refining solutions at this time. Within about five years the use of *p*H measurements became common for the control of nickel baths. Major credit for this step forward should be given to Dr. Blum and his collaborators at the National Bureau of Standards.

In 1921 Dr. Blum elaborated on *p*H measurement in a paper on the use of fluorides in nickel solutions,[79] and gave curves showing the buffering effect of boric acid and fluorides. The outstanding paper serving to introduce the method into nickel plating practice was that of Thompson in 1922.[80] This was followed by a series of investigations on the desirability of various methods of *p*H measurement and control,[81–90] and the introduction of inexpensive equipment for the purpose.[53–55]

Blum and Bekkedahl[91, 92] reviewed the developments, and showed that the colorimetric methods in common use generally gave results about 0.5 *p*H unit higher than the electrometric measurements or the true *p*H.

The buffering action of various chemicals or weak acids in nickel baths was studied in some of the above investigations on the measurement of *p*H. O. P. Watts[93] discussed the subject at some length, and suggested the use of acetates. D. A. Cotton reported an excellent investigation also.[94] While nickel baths are commonly acid, Saubestre[95] recently re-examined the possibilities of nickel plating from alkaline baths, a question which has received little consideration since the difficulties with such baths in the early days.

THE WATTS BATH AND HOT, HIGH-SPEED PLATING

We have already seen that Dr. Adams had some familiarity with hot solutions and single salt baths in the beginning of the use of nickel plate. Brownell[25] also mentioned the use of hot baths. The next important contribution was that of Foerster in 1897,[83] which was perhaps connected in some way with contemporaneous developments in nickel refining.[96, 97]

Foerster credited Classen's book on Electroanalysis published in 1882 as part of his inspiration, since Classen used a hot ammoniacal solution for nickel determination. At any rate, Foerster obtained good results with both nickel sulfate and nickel chloride baths at temperatures up to 70–90C and current densities of 20–80 amperes per square foot, with air agitation. The sulfate baths were easier to operate than the chloride; but chloride solutions gave good results with 2.5 g/l of hydrochloric acid added, with very little decrease in current efficiency. Good deposits were produced to a thickness of about 1 mm (0.04 in.). Foerster also reviewed his results in the first edition of his book in 1905 (reference 98, pages 251–252).

Another worker who used hot solutions at the turn of the century was M. Kugel[99] of Berlin. Kugel was interested in electrotyping and electrorefining, and patented a solution containing for example 800 g/l nickel sulfate and 800 g/l magnesium sulfate when operating at 90C (194F). He claimed to be able to use current densities up to 93 to 186 amps/sq. ft with good agitation.

Blount, in 1901[100] reviewed the status of both nickel refining and plating, and based on Foerster's work, strongly recommended warm solutions of single salts for plating purposes. Johnson[101] stated that the use of a hot solution is bad, as it accelerates the formation of basic salts at the cathode, and again[102] that it makes the solutions turbid, and causes rough plate. Browne[103] got good results in the electrolytic production of starting sheets for nickel refining by using hot solutions of both single salts and double salts, and also of nickel chloride.

Kern and Fabian[104] and Kern [105] reported good results with hot solutions, whether sulfate, chloride, silicofluoride, or fluoborate. Schloetter[106] reviewed the literature rather thoroughly, including work on hot solutions by Foerster, Roemmler, Marino, and Kugel, but made no recommendation either for or against the use of warm baths. Brown, in 1911,[107] favored the use of single salts and agitated solutions, but stated that "Heated solutions are sometimes used but should not receive too much consideration as unless great care is employed the deposits are liable to be spongy."

Into this welter of confusion stepped Professor O. P. Watts of the University of Wisconsin. He made a comprehensive study of the literature and patents on nickel deposition in 1913,[108] without drawing many conclusions. A few years later, in 1915,[109] he reported on the work in progress in his laboratory, and mentioned obtaining good deposits up to 1257 amp/sq ft in hot, concentrated solutions with a cathode rotating at 1000 rpm. Later in 1915, a second edition of Foerster's book appeared (reference 110, pages 425–430, 479–483), with a strong recommendation for the use of hot solutions if thick deposits were desired.

It should be remembered that these workers had no close control over the acidity of their baths such as was developed in the 1920's.

The stage was now set for the final development of the modern high speed nickel bath, but this development was quite fortuitous, and by no means a foregone conclusion. Early in 1915, the Canadian Department of Mines published[111] a remarkable study of room temperature cobalt plating by H. T. Kalmus, et al, seeking to find a use for a substantial accumulation of cobalt resulting from silver production. This investigation was made at Queens University, Kingston, Ontario, on a cooperative basis with the Russel Motor Car Company of Toronto for plant tests. The plater at the Russel Motor Car Company, W. S. Barrows suggested a formula for a cold nickel bath to the research workers as being a satisfactory and rapid bath for nickel plating, and which contained nickel sulfate, sodium chloride, and boric acid.

Kalmus et al proceeded to make up an analogous cobalt solution which they called XIII A, but it was of too low a concentration, and not nearly saturated in cobalt sulfate. They then proceeded to make up their best solution called XIII B on a similar basis and substantially saturated in cobalt sulfate. They also made up a similar nickel bath for comparison purposes, called XIII C. Only three tests were reported with this nickel bath; it gave good results with a 20 minute plate at about 36 amp/sq ft, but splitting at the edges at higher current densities. The compositions of these three solutions were as follows:

XIII A

$CoSO_4$ anhyd.	181.2 g/l
NaCl	11.35 g/l
H_3BO_3	37.8 g/l

XIII B

$CoSO_4$ anhyd.	312.5 g/l
NaCl	19.6 g/l
H_3BO_3	nearly to satn.

XIII C

$NiSO_4$ anhyd.	312.5 g/l
NaCl	19.6 g/l
H_3BO_3	nearly to satn.

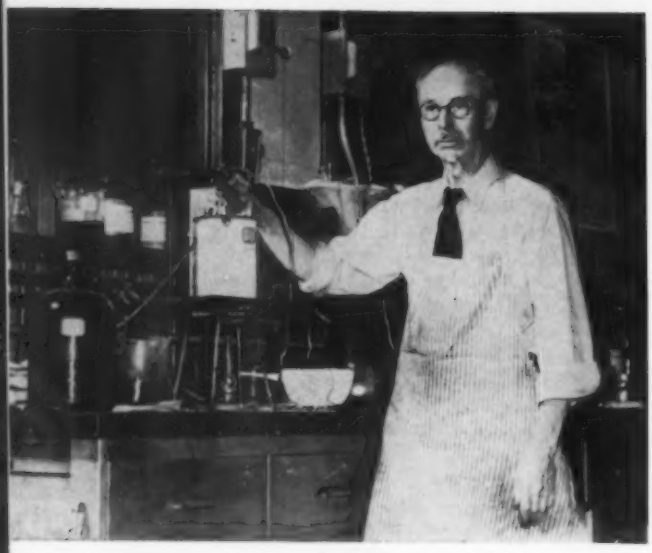
Solution XIII A was found to be unsatisfactory for plating purposes, but the virtues of solution XIII B are extolled at great length, particularly the extremely high current densities which can be used (over 150 amp/sq ft), even at room temperature. After plant tests it was concluded that solution XIII B was capable of plating various sizes and shapes of objects under commercial conditions at a speed at least 15 times as great as that of the fastest satisfactory nickel solution.

An extensive extract from the above report was published as an Electrochemical Society paper in April, 1915.[112] It related largely to solution I B, a 145 g/l cobalt ammonium sulfate solution, and solution XIII B. In some communicated discussion Professor Watts reported obtaining about as high current densities with some highly concentrated iron, copper, nickel and cobalt solutions, as Kalmus et al had obtained with cobalt. In concluding the discussion, Dr. Kalmus minimized the high cost of cobalt, and stated that he did not believe that nickel could be plated continuously under commercial conditions at as high current densities as cobalt.

Professor Watts accepted the challenge, and the result was his paper a year later,[113] and the Watts Bath, as we know it today. The formula he suggested was:

	grams/liter	oz/gallon
$NiSO_4 \cdot 7H_2O$	240	32
$NiCl_2 \cdot 6H_2O$	20	3
H_3BO_3	20	3

The use of 4 oz/gal NaCl instead of $NiCl_2$ was investigated



Professor O. P. Watts about 1945

but found not as good, since the $NiCl_2$ permitted a higher current density. The question of agitation was not discussed, but Professor Watts concluded that a hot solution must be used, and recommended 70C (158F). Under these conditions he found that current densities up to 200 to 300 amp/sq ft could be employed.

The Watts Bath was not immediately adopted by industry, but very slowly, over a period of many years. Perhaps the first to take full advantage of it on a large scale was Professor E. M. Baker[114] with whom the writer had some association in 1923. Professor Baker's process of nickel, acid copper, nickel worked quite well on steel bumper bars (C. G. Spring and Bumper Company; later General Spring and Bumper Company and Houdaille-Hershey Corporation).

Blum and Hogaboom recommended the Watts bath in the first edition of their book in 1924,[115] as well as in the second edition of 1930 and the third edition in 1949.[65] The Watts bath was also featured in a paper by Thomas and Blum,[116] in 1925, and recommended in France by J. Galibourg[117] in 1927.

In 1931 Professor Watts published a survey on the extent to which hot nickel solutions had come into use.[118] While it was evident that the adoption of hot nickel baths had not progressed as far in the trade as might have been expected, the survey did show that probably about 200,000 gallons or more of hot nickel was in operation.

This was Professor Watts last publication regarding the Watts bath. He died February 6, 1953 at 87.[119] Born July 16, 1865 in Thomaston, Maine, he was four years old when Dr. Adams introduced nickel plating.[120] Curiously enough, he graduated from Bowdoin College in 1889, the same school where Dr. Adams had graduated in 1858. Professor Watts received the PhD degree from the University of Wisconsin in 1905, and taught there until his retirement in 1937. He was always a kindly, unassuming, and well-liked person. A remarkable feature of his career was the extent to which he bridged the gap between the research laboratory and the practical plater. His frequent appearances at Chicago Branch meetings often included impromptu and helpful talks on a wide range of subjects.

As might be expected, the Watts bath was subjected to many modifications from time to time. The remarkable thing is that it should have survived, essentially unaltered, after more than 40 years. An excellent study of the optimum metal concentration was published by Cotton.[121] Phillips[122–124] introduced the use of a lower *p*H. The chloride content was frequently increased, so that high-chloride[125] and even all-chloride baths[126, 127] are sometimes used.

For anyone interested in a more detailed survey of nickel plating since Professor Watts review in 1913[108] the publications of Ewing et al[128] and Mellor[129] can be recommended. The chemistry of Watts baths was discussed by Saubestre in 1958.[130]

The main reason for the survival of the Watts Bath is probably that it forms the best base for modern bright nickel solutions. While the original formula gave about 7.5 oz/gal of nickel, Pinner, Soderberg and Wesley (reference 131, pages 299–355) state that for bright nickel baths " . . . the nickel content is somewhat higher, 10 to 12 oz/gal, the chloride ion content should be at least 1.8 oz/gal and, in some solutions, as high as about 6 oz/gal, and the boric acid content should be not less than 5.0 oz/gal."

In addition to that of Pinner et al,[131] a comprehensive review of modern nickel plating technique is given by Dr. R. S. Springer in Pfanhauser's book (reference 132, pages 453–608). Many reprints and much technical information are also readily available at all times from the International Nickel Company.

OTHER BATHS

Several other nickel baths have been placed on the market recently, but seem of somewhat limited application. The General Chemical Division of the Allied Chemical & Dye Corp. offer a nickel fluoborate bath, and the Barrett Chemical Products Co. of Shelton, Conn. a sulfamate bath.

Roehl and Wesley[133] review the history of fluoborate nickel baths briefly, and give the results of some tests in comparison to Watts and to chloride baths. Fluoborate baths have high solubility and high conductivity, and give nickel deposits of unusual physical properties such as low stress and high strength. These properties led to some special uses such as printing plates,[134] barrel plating,[135] and electroforming.[136]

A comprehensive investigation of the physical properties of nickel deposits by Zentner, Brenner and Jennings included measurements on deposits from fluoborate baths.[137] A more extensive study of nickel fluoborate baths was published by Young and Strobach in 1955,[138] but the use of fluoborate baths seems somewhat restricted by their cost and corrosiveness.

Similarly to the fluoborate baths, sulfamate solutions have become available for nickel plating, and give deposits with low stress, and other desirable physical properties. Diggin[139] reviewed the history of the subject and investigated two bath compositions. Another excellent investigation is that of Barrett,[140] who is engaged in marketing this type of solution.[141]

Newell[142] also investigated the low stress and the hardness of sulfamate nickel deposits. Several recent articles[143, 144] indicate continued interest in the subject and confirm the desirable properties of the deposits, including minimum effect on the fatigue strength of steel. However, as with fluoborate, there is always the question of whether or not the increased cost is justified.

BRIGHT NICKEL PLATING

In a sense, all nickel deposits are bright. If the basis metal has been buffed to a high luster, nickel deposits up to almost 0.0001 in. thick will be quite bright without buffing. Some

work was done this way in the early days (and some still is), and tended to give nickel plating a bad name due to lack of durability. Pfanhauser deprecated this practice in 1900 (reference 48, pages 387–389), and recommended heavier nickel plating followed by polishing and buffing.

The polishing and buffing costs are substantial and may even exceed the cost of plating. Consequently, constant efforts have been made to reduce these costs. One such step is to plate steel with copper as an undercoat, and then to buff the copper, as this is much more easily accomplished than the polishing of the steel.

Johnson[146] gives a review of earlier attempts at bright nickel plating. Proctor[146, 147] recommended the addition of cadmium salts; which were discovered to be brighteners in nickel plating solutions at the Elkington plant in Birmingham, England in 1912. Shepard[148] and Pinner and DeWitt[149] used lead salts. Solutions containing a high concentration of sodium or other sulfate and used for plating zinc base die castings, tended to plate bright.[150] Nickel deposits on zinc die castings seem brighter than on other basis metals; either due to the ease of buffing of zinc, or to the mild brightening action of zinc dissolved in the nickel bath, or both.

Organic brighteners were also frequently tried in early work. Schloetter in 1910[106] reported good bright deposits with Jordis' lactate bath.[73] Gardner[151] used glycerin with cadmium salts, as did also Murphy.[152]

Shepard[148] also used glycerin with lead. Todd and King[153] patented gum tragacanth, and this brightener was sold for many years.

These early bright nickel baths were generally difficult to control, and usually gave only thin, brittle deposits. Credit for the introduction about 1933 of the modern type of bright nickel using aromatic sulfonates and giving thicker, less brittle deposits, is generally given to Professor Max Schloetter of Berlin, Germany. Schloetter had established a plating supply company in Germany in 1912, and was stated to have 73 issued patents in 1930,[154] relating largely to tin, iron, copper, lead, and zinc plating. He had used aromatic sulfonates in some of these other processes, and proceeded to apply them to the production of better nickel plate.

Schloetter's basic U. S. patent appears to have been filed first, in 1932.[155] A Canadian patent was filed in 1935.[156] The German patent filed in 1934[157] does not seem to have been granted. A British patent filed in 1935[158] was somewhat different in emphasizing the use of alkali or alkaline earth chlorides in addition to the aromatic sulfonates. Another German patent[159] related to the improvement of throwing power of chromium by plating directly over a fresh bright nickel deposit. This was described in several articles also.

Schloetter advertized his new bright nickel in Germany Dec. 1, 1933[160] and some publicity appeared a few weeks later.[161] In the United States the process was sold by the Pyrene Manufacturing Company, and announced in February 1934.[162] Results with the new process were described a few months later by Eckelmann.[163]

The writer had the pleasure of a brief meeting with Professor Schloetter in March 1930, while employed at the Udylite Process Company, and when Schloetter was visiting the United States. Schloetter was said to have over 150 patents at the time he was 60,[164] and died May 22, 1946 at 67.[165] The firm which he founded continues in business in Germany.

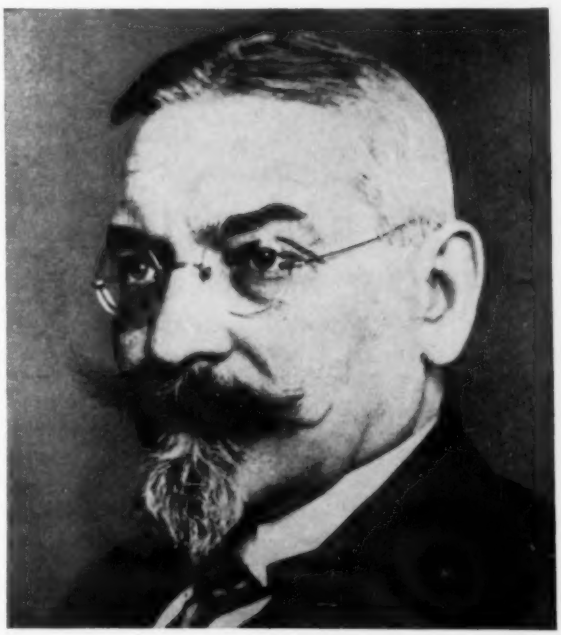
The sale of the Pyrene High Gloss nickel process in the United States soon proved to the skeptics that bright nickel plating was practical and had a place in the scheme of things. The Schloetter patent U. S. 1,972,693 later came to be recognized as a basic one, and it contained article claims on high gloss nickel deposits having a crystal size less than about one ten-thousandth of a millimeter. Other bright nickel processes soon developed independently of the Schloetter-Pyrene process, however.

Outstanding among these was the Hanson-Van Winkle-Munning Co. process[166, 167] based on the Weisberg and Stoddard patent[168] and two later patents of Viers and Case.[169, 170] This process was based upon the use of cobalt-nickel alloy plates.[171] At first[172] 18 per cent cobalt was used in the anodes, together with sodium formate and formaldehyde additions, but later[173] the amount of cobalt was reduced to five per cent and even to about one per cent for semi-bright deposits.

The Harshaw Chemical Company announced a bright nickel process in May, 1935[174] and mentioned it again in May 1936;[175] but then did not advertise bright nickel specifically in Metal Industry until October 1940.[176] The Udylite Company announced a bright nickel process in February and March 1938.[177, 178] The Seymour Manufacturing Company announced a process in April 1938,[179] and the McGean Chemical Company in May 1938[180] and April, 1939.[181]

In order to take care of licensing arrangements under the Schloetter patent, a Bright Nickel Corporation was formed in October, 1938[182] which advertised for three months.[183] This corporation included as sublicensing agents: Harshaw Chemical Company, McGean Chemical Company, Pyrene Manufacturing Company, Seymour Manufacturing Company and the Udylite Company. A few months later the Udylite Corporation was formed and acquired the Bright Nickel Corporation.[184]

The new bright nickel processes were found to require a wetting agent to prevent pitting. The best wetting agent found was sodium lauryl sulfate, and its use was covered by a patent to Waite and Martin.[185] This patent was at one time



Professor Max Schloetter

in interference with another of Mougey and Wirshing,[186] but the interference was decided in favor of Waite and Martin.[187] Royalties were paid under this patent for many years, but it expired August 26, 1958.

Ever since 1934 much research has gone into developing improved bright nickel plating processes. The benzene disulfonate and naphthalene trisulfonate introduced by Schloetter[155] were dependable brighteners which could be used in substantial amounts without harmful effects, but they did not give full brightness with thick deposits, or a high rate of brightening with increasing thickness on a slightly dull surface.

It was soon found that other more powerful brighteners could be added in very small amounts which were compatible with the Schloetter type brighteners, and made considerable improvement. The Schloetter type brighteners which are used in large amounts and do not have a critical concentration, became known as secondary brighteners; while the more powerful brighteners used in small amounts to get mirror brightness at a high rate, became known as primary brighteners, even though they could not be used without the secondary brighteners. The secondary brighteners are sometimes known as "ductilizers" or "carriers", while the primary brighteners tend rapidly to brittleness, and can generally be used only in small amounts.

An excellent review by Such in 1955[189] gives some more or less quantitative measurements on these effects. Several standard textbooks[55, 131, 189, 192] use a different nomenclature and call brighteners of the Schloetter type "brighteners of the first class", and primary brighteners, "brighteners of the second class." A review in 1958 by Fishlock[190] reverses the classifications, either accidentally or in the effort to reconcile them.

It is best to be familiar with both types of designation. The distinction is also not always a sharp one, and many new developments are being made in nickel brighteners of both types. It may be of interest to tabulate some of the more important United States and Canadian patents. All patents prior to June 1942 have of course expired. Most of the earlier expired patents are omitted as these have been adequately reviewed by Pinner et al in 1941 (191; reference 192, pages 235–274) and in 1953 (reference 131, pages 299–355). Wetting agent patents are also not included.

SECONDARY BRIGHTENERS

Patent No.	Date	Inventor	Company	Brightener
1,972,693	9–4–34	M. Schloetter	Pyrene	Aromatic polysulfonates
2,191,813	2–27–40	H. Brown	Udylite	Aromatic Sulfonamides and Sulfonimides (Saccharin)
2,401,428	6–4–46	M. Kosmin	Monsanto	Polysulfonates of isomeric biphenyl benzenes
2,409,119	10–8–46	M. L. Freed	Seymour	Orthosulfobenzaldehyde or other sulfonated aryl aldehyde
2,426,416	8–26–47	E. W. Schweikher	duPont	Metasulfobenzaldehyde
2,427,280	9–9–47	R. A. Hoffman	duPont	2 Phenyl ethylene sulfonic acid
2,455,555	12–7–48	H. Brown	Udylite	2-Nitrovinyl benzene sulfonic acid
2,466,677	4–12–49	H. Brown	Udylite	Alpha and Beta unsaturated aliphatic sulfonamides and sulfonimides
2,467,580	4–19–49	H. Brown	Udylite	Sulfonated Aryl sulfones
2,469,727	5–10–49	R. A. Hoffman	duPont	Sultones
2,523,190	9–19–50	H. Brown	Udylite	Vinyl Sulfonic Acids
2,523,191	9–19–50	H. Brown	Udylite	Allyl Sulfonic Acids
2,579,636	12–25–51	L. Weisberg	—	Coumarin and formaldehyde
2,635,076	4–14–53	A. H. DuRose	Harshaw	Coumarin and derivatives
2,683,115	7–6–54	A. H. DuRose	Harshaw	Coumarin and derivatives plus formaldehyde
2,694,041	11–9–54	H. Brown	Udylite	Coumarin Sulfonic Acid
2,748,068	5–29–56	C. L. Faust et al	Rockwell	Sulfonated phthalide or naphthalide
2,757,133	7–31–56	W. J. Shenk Jr.	Harshaw	Diaryl Sulfonamides
2,800,440	7–23–57	H. Brown	Udylite	Alkyne and Alkynoxy Sulfonic Acids
2,800,441	7–23–57	H. Brown	Udylite	Alkynoxy Alkane Carboxylic Acids
2,800,442	7–23–57	H. Brown	Udylite	Aryl Alkyne and Aryl Alkynoxy Sulfonic Acids
2,848,392	8–19–58	H. E. Ford et al	Harshaw	Polyoxyethylene tetra-aryl disulfonamides

CANADIAN PATENTS ON SECONDARY BRIGHTENERS

Patent No.	Date	Inventor	Company	Brightener
356,538	3–10–36	M. Schloetter	Pyrene	Aromatic polysulfonates
412,469	5–11–43	H. Brown	Udylite	Saccharin (See U. S. 2,191,813)
412,472	5–11–43	H. Brown	Udylite	Substituted benzene sulfonates
412,473	5–11–43	H. Brown	Udylite	Substituted benzene sulfonates
450,536	8–17–48	R. A. Hoffman	duPont	2-Phenyl ethylene sulfonic acid
450,538	8–17–48	R. A. Hoffman	duPont	m. or p. sulfobenzaldehyde
463,174	2–14–50	R. A. Hoffman	duPont	sultones
502,633	5–18–54	A. H. DuRose	Harshaw	Coumarin
541,900	6–4–57	W. J. Shenk Jr.	Harshaw	Sulfonamides and disulfonamides
558,991	6–17–58	M. M. Beckwith	Harshaw	Duplex nickel (coumarin)

PRIMARY BRIGHTENERS

Patent No.	Date	Inventor	Company	Brightener
2,125,229	7–26–38	W. J. Harshaw et al	Harshaw	Selenium and Tellurium Compounds
2,198,267	4–23–40	R. Lind et al	Harshaw	Tri and Diphenyl methane derivatives
2,198,268	4–23–40	R. Lind et al	Harshaw	Triphenyl Methane derivatives
2,211,525	8–13–40	H. Brown	Udylite	Aryl arsonic acids
2,238,861	4–15–41	R. Lind et al	Harshaw	Aromatic Amines
2,290,342	7–21–42	R. Lind et al	Harshaw	Azo Dyes
2,291,590	7–28–42	R. Lind et al	Harshaw	Thiazine Dyes
2,294,311	8–25–42	R. Lind et al	Harshaw	Amino polyaryl amines
2,315,802	4–6–43	R. Lind et al	Harshaw	Alkaloids
2,321,182	6–8–43	H. Brown	Udylite	Halogenated aldehydes
2,326,999	8–17–43	R. Lind et al	Harshaw	Safranine compounds
2,361,720	10–31–44	W. P. terHorst	Seymour	Mercapto pyrimidines
2,402,801	6–25–46	H. Brown	Udylite	Thallium
2,409,120	10–8–46	M. L. Freed et al	Seymour	Thiourea compounds
2,417,203	3–11–47	R. O. Hull et al	duPont	Sulfurized gelatin
2,485,149	10–18–49	M. L. Freed et al	Seymour	Mercaptopyrimidines
2,513,280	7–4–50	H. Brown	Udylite	N-alkyl pyridinium and quinolinium pyrazoles
2,524,010	9–26–50	A. H. DuRose et al	Harshaw	Aliphatic and aromatic nitriles
2,528,902	11–7–50	P. W. Moy et al	Harshaw	Thiophene sulfonic acids
2,539,588	1–30–51	P. W. Moy	Harshaw	Thianaphthene dioxide derivatives
2,550,449	4–24–51	H. Brown	Udylite	Pyridinium and Quinolinium Pyrazoles
2,635,076	4–14–53	A. H. DuRose	Harshaw	Coumarin and derivatives
2,637,687	5–5–53	L. B. Portzer et al	Smoothex	Reduced triphenylmethane dye
2,644,788	7–7–53	W. J. Shenk Jr.	Harshaw	Pyridinium carboxylates
2,644,789	7–7–53	W. J. Shenk Jr.	Harshaw	Bis pyridinium halides
2,647,866	8–4–53	H. Brown	Udylite	Alkylquinolinium and pyridinium halides
2,648,627	8–11–53	H. G. Donnelly	Wagner	Isothioureido compounds
2,648,628	8–11–53	H. Brown	Udylite	Quinoline, Isoquinoline and C-alkyl homologues
2,654,703	10–6–53	H. Brown	Udylite	Aryl sulfinates
2,654,704	10–6–53	H. Brown	Udylite	Quinolinium compounds
2,658,867	11–10–53	J. D. Little	Harshaw	Alkyl pyridinium and quinolinium halides
2,662,853	12–15–53	D. G. Ellis	Harshaw	Polyalkylene amines and substituents
2,664,392	12–29–53	N. F. Blackburn	Pennsalt	Benzoic sulfimide and sulfurized quinoidine
2,678,910	5–18–54	H. Brown	Udylite	Aliphatic esters of unsaturated aliphatic polycarboxylic acids
2,683,115	7–6–54	A. H. DuRose	Harshaw	Coumarin plus formaldehyde
2,684,327	7–20–54	F. Passal	Metal & Thermit	Amino indazoles
2,690,996	10–5–54	H. Brown	Udylite	Esters of unsaturated aliphatic monocarboxylic acids
2,712,522	7–5–55	O. Kardos et al	Hanson	Water soluble acetylenic compounds
2,737,484	3–6–56	F. Passal	Metal & Thermit	2 Mercapto benzimidazoles
2,781,305	2–12–57	H. Brown	Udylite	Unsaturated amides
2,781,306	2–12–57	H. Brown	Udylite	Allyl urea
2,782,152	2–19–57	A. H. DuRose	Harshaw	Coumarin plus amino polyaryl methanes
2,782,153	2–19–57	A. H. DuRose et al	Harshaw	Coumarin plus pyridinium and isoquinolinium halides
2,782,154	2–19–57	A. H. DuRose et al	Harshaw	Alkylene Amines
2,782,155	2–19–57	A. H. DuRose et al	Harshaw	Polyalkylene glycols
2,784,152	3–5–57	D. G. Ellis	Harshaw	Polyalkylene glycols
2,795,540	6–11–57	H. Brown	Udylite	Alkoxy coumarin
2,818,376	12–31–57	D. G. Foulke et al	Hanson	Thiomalic acid
2,836,549	5–27–58	F. I. Nobel et al	Lea-Ronal	Acetylenic polyamines
2,839,456	6–17–58	D. G. Foulke et al	Hanson	Pyridyl ethyl sulfonic acids
2,839,457	6–17–58	D. G. Foulke et al	Hanson	Aromatic N-oxides
2,839,458	6–17–58	D. G. Foulke et al	Hanson	Aromatic phosphinic acids
2,839,459	6–17–58	D. G. Foulke et al	Hanson	Amino pyridines, etc.
2,839,460	6–17–58	D. G. Foulke et al	Hanson	Bis pyridyls
2,841,602	7–1–58	H. Brown et al	Udylite	Alkynoxy acids
2,849,353	8–26–58	O. Kardos	Hanson	Butene diol
2,852,449	9–16–58	D. H. Becking et al	Udylite	Vinyl substituted m-dioxane compounds
2,870,069	1–20–59	B. D. Ostrow	—	Polyamine reaction products with unsaturated aldehydes and esters
2,872,392	2–3–59	B. P. Martin	McGean	Lignosulfonates

CANADIAN PATENTS ON PRIMARY BRIGHTENERS

Patent No.	Date	Inventor	Company	Brightener
402,363	1–20–42	W. J. Harshaw et al	Harshaw	Selenium and Tellurium (U. S. 2,125,229)
404,936	5–26–42	R. Lind et al	Harshaw	Aminopolyarylmethane dyes (U. S. 2,198,267—2,198,268)
412,470	5–11–43	H. Brown	Udylite	Aliphatic polyketones and aldehydes
412,471	5–11–43	H. Brown	Udylite	Saccharin plus a ketone
459,337	8–30–49	H. Brown	Udylite	Pyridinium or quinolinium pyrazoles
459,338	8–30–49	H. Brown	Udylite	Substituted N-alkyl derivatives of pyridine, quinoline, etc.
459,339	8–30–49	H. Brown	Udylite	Pyrazole derivatives (pyridyl and quinolyl)
503,726	6–15–54	H. Brown	Udylite	N-alkyl derivatives of pyridine, quinoline and isoquinoline
509,780	2–1–55	H. Brown	Udylite	Quinoline compounds (see U. S. 2,648,628)
521,410	1–31–56	F. Passal	Metal & Thermit	Indazole derivatives
523,819	4–10–56	H. Brown	Udylite	Aliphatic ester of unsaturated aliphatic polycarboxylic acid
541,899	6–4–57	O. Kardos et al	Hanson	Acetylenic compounds (see U. S. 2,712,522)
546,333	9–17–57	W. J. Shenk Jr.	Harshaw	Pyridinium and quinolinium compounds
549,805	12–10–57	L. B. Portzer	Smoothex	Reduced triphenylmethane dye
558,444	6–10–58	F. I. Nobel et al	Lea-Ronal	Amino acetylenic compounds (see U. S. 2,836,549)
562,678	9–2–58	O. Kardos	Hanson	Water soluble olefinic alcohol-butene diol (See U. S. 2,849,353)
563,564	9–23–58	H. Brown	Udylite	Substituted quinoline and isoquinoline heterocyclics

Pure Nickel,
Nickel Alloys,
Nickel Castings,
Nickel Salts,
Cobalt,
Cobalt Oxide,
Blue Vitriol,
Copperas, &c.

PROPRIETOR,
JOSEPH WHARTON,
Post Office Address,
BOX 2386, PHILADELPHIA.

AMERICAN NICKEL WORKS,

Camden, N. J., Jan. 29, 1872.

MR. E. L. ZALINSKI,—

Dear Sir:

In reply to your favor of 26th inst., I have to state that nickel wire is not made, and never has been made, except a very trifling quantity, quite regardless of cost, by St. Clair Deville, for the purpose of gaining data as to tensile strength of wrought nickel. I have, however, occasionally made cast rods of nickel 1-4 inch in diameter, and might perhaps get them three or four feet long, though it is difficult to make them so thin of a greater length than two feet. The price of cast-nickel plates for anodes is three dollars per pound; of 1-4 inch rods, the same plus whatever extra cost might arise from the failure of a proportion of the castings, this latter depending mainly on the length required, and reaching probably one dollar, ($1.00) per lb. The price of sulphate of nickel is $2.50 per lb.

The price of sulphate of nickel and ammonia, $2.00 per lb.

I give the price of the latter salt, though you do not ask it, because it will almost certainly be more advantageous for you to get the carefully made salt ready for use in plating, than to undertake to make it yourself from the simple sulphate of nickel.

Very Respectfully,

JOSEPH WHARTON.

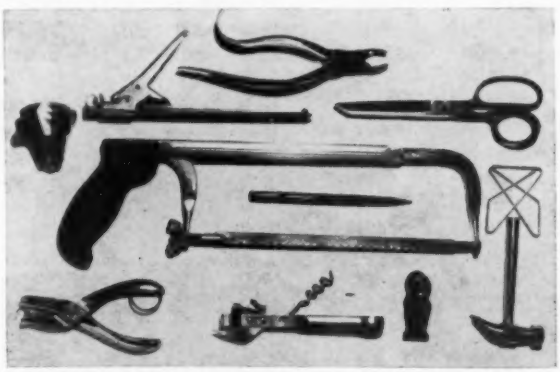
All the above are wholesale prices; both of the salts are very carefully made, and are commercially, almost chemically, pure. The double sulphate I have always on hand, as I supply probably all the nickel-platers in this country and some in Europe.

Early quotation on nickel anodes and salts

CONSUMPTION OF NICKEL IN ELECTROPLATING

Nickel might be considered the "work horse" of the plating industry. It is not commonly realized that nickel is used very extensively as a final finish, particularly on household articles not exposed to a corrosive atmosphere. Nickel plate will resist tarnishing indefinitely in protected locations. The writer has in his possession several articles plated over 50 years ago which show essentially no corrosion or tarnishing, due to having been protected from the atmosphere. The atmosphere of the ordinary household is essentially non-corrosive to nickel, and some nickel plated articles retain their bright finish for many years, if not indefinitely.

Only scattered estimates are available on the amount of nickel used in electroplating. In 1874 the price of nickel anodes was $3.00 to $5.00 per pound (reference 1, pages 192, 222–223) and most of them were produced by the American Nickel Works of Joseph Wharton in Philadelphia. Wahl states (reference 193, page 365) that Mr. Wharton produced 1,466,765 lb of nickel in the six year period 1876–1882, from the ore of Lancaster Gap, Pennsylvania, which contained only 1.5-2 per cent nickel. There was some nickel imported from Europe also, but up until 1890 a high proportion of the nickel produced was used in electroplating. It thus seems a



Articles sold with bright nickel or buffed nickel finish

fair estimate to say that about 300,000 lb of nickel anodes were used per year in the early days, but this is pure guesswork.

In 1910 Buchanan[194] estimated that about 1,000,000 lb of nickel was cast into anodes yearly, presumably in the United States alone. The amounts of nickel used annually for plating in the United States or in the world are summarized below. Figures given by the Bureau of Mines for nickel consumed as salts have been enlarged and added to the total according to estimates of the Bureau. The International Nickel Company[203] estimates that the figure for 1957 may be about 10,000,000 lb too high due to buying for inventory, and the figures for 1958 consumption correspondingly low.

The figures reflect the effects of wars, depressions, and government restrictions, as well as improvements in technology such as the use of thicker plate or the introduction of bright plating. One can hope that we are entering a period where we will see what nickel plating will do for us when unfettered by economic conditions or restrictions.

Source	Year	Per cent for Plating	Consumption in lb/yr
Wahl[193]	1883	about 90	about 300,000
Buchanan[194]	1910	—	about 1,000,000
Hogaboom[195]	1926	—	about 2,500,000 (anodes)
Taylor[196]	1929	—	about 4,000,000 to 6,000,000
Eckelmann[163]	1933	8.8 to 10.5	5,000,000 to 6,000,000
Hogaboom[195]	1935	—	about 6,600,000 (anodes)
International Nickel Co.[197]	1935	10	14,000,000 (World) 7,000,000 to 8,000,000 (U. S.)
M. Tremblay[198]	1937	10	24,000,000 (World)
	1938	6	12,240,000 (World)
	1939	8	20,000,000 (World)
Minerals Yearbook[199]	1945	about 6.6	12,736,348
Minerals Yearbook[199]	1946	about 11.3	18,193,138
Minerals Yearbook[199]	1947	about 12.7	20,411,871
R. C. Stanley[200]	1947	11	22,000,000
Minerals Yearbook[199]	1948	about 16.6	31,080,509
Minerals Yearbook[199]	1949	about 22.4	30,517,934
Minerals Yearbook[199]	1950	about 19	37,810,031
R. J. McKay[77]	1950	—	40,000,000 (World)
Minerals Yearbook[199]	1951	about 7.3	12,640,000
Minerals Yearbook[199]	1952	about 7.0	14,214,000
Minerals Yearbook[199]	1953	about 14.4	30,436,000
Minerals Yearbook[199]	1954	about 17.0	32,212,000
Minerals Yearbook[199]	1955	about 15.7	34,682,000
K. E. Volk[201]	1955	15	57,000,000 (World)
Minerals Yearbook[199]	1956	about 13.9	35,484,000
Minerals Yearbook[199]	1957	about 20.6	50,478,000 (high due to high inventories)
J. F. Thompson[202]	1958	15 to 18	—
W. Prine[203]	1958	—	about 18,000,000

ACKNOWLEDGEMENT

Only two weeks before he died Dec. 31, 1953, Mr. Hogaboom sent the writer a box of Isaac Adams' papers and mementos. These have been considerably augmented by gifts from Dr. Adams' two daughters-in-law, Mrs. Rayne Adams of Annisquam and Mrs. Walter O. Adams of Gloucester, Mass., whose conscientious help has been an inspiration. E. H. Davis of Waterbury, Conn. also contributed material. Frank Passal of Metal & Thermit Corporation has likewise given considerable assistance, especially with the section on bright nickel plating.

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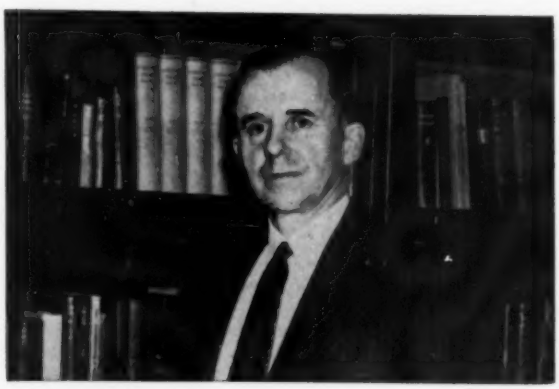

George Dubpernell is a graduate of the University of Michigan, 1924, where he was associated with the late Professor E. M. Baker. Dr. Dubpernell then worked and studied under Dr. Colin G. Fink at Columbia University and received the AM degree from that institution in 1927. Returning to Michigan he studied under Professor A. L. Ferguson and received the PhD degree in 1933 for work on overvoltage. His early experience with plating which began in 1919 included work on lead plating (Detroit Battery Company), zinc (Harris Zinc Process Company and Apollo Metal Works), copper and nickel (C. G. Spring & Bumper Company), and cadmium (The Udylite Corporation). He has been associated with the development of chromium plating since 1925, from 1933 on with United Chromium, Inc., now Metal and Thermit Corp. Dr. Dubpernell has authored many papers on electroplating and overvoltage. He is a member of the American Electroplaters' Society, American Chemical Society, Electrochemical Society, Institute of Metal Finishing, ASM and AIME.

TIN IN ELECTROPLATING

by ROBERT M. MacINTOSH*

THE WIDESPREAD USE OF TIN as an electrodeposited coating for metals can be attributed to a number of its special properties. A tin coating is ductile and follows the movement of the basis metal when formed into useful shapes. It has good resistance to tarnishing and corrosion and since tin is non-toxic it makes an excellent coating for steel containers which hold foods, beverages and hundreds of miscellaneous products. Tin coated metal can be stored for long periods without deterioration and the ease with which it can be soldered is a valuable asset in fabrication. The advances in electrotinplating processes in the last 25 years have spearheaded revolutionary changes in many of our large industries such as the tin plate container and electronic industries.

Prior to 1930, the only commercially important electrolytes were modified alkaline baths. The sodium stannate bath was introduced in 1921, but the major expansion of tinplating followed Wernlund and Oplinger's discovery[1] that low concentrations of stannate and caustic soda and filmed anodes were needed to avoid spongy deposits. From 1933 to 1941, the sodium stannate bath came into general use in still and automatic units because of the simplicity of make-up and control and excellent throwing power. The only drawback was its lack of good cathode efficiency at high current densities. In 1942, Sternfels and Lowenheim[2] introduced the potassium stannate electrolyte. The greater stability and solubility of potassium salts made possible the use of higher current densities resulting in a two or threefold increase in plating speed.

Schlötter's patent in 1930[3] and Pine's patent in 1935[4] introduced improvements in the stannous sulfate electrolyte. Addition agents of cresol, beta naphthol and glue made possible an "acid" electrolyte which would deposit tin two or three times faster than the alkaline baths for a given current and would operate at room temperature.

These improvements in the alkaline and acid tinplating processes began to interest the steel makers and the idea of continuously coated tin plate was a natural outgrowth of the development of cold rolling steel to tin plate gages in strip form. In the early 1930's, at least two pilot lines for electrotinning steel strip up to eight inches in width were being used for experiments. It was readily determined that variable coating thicknesses could be applied on a practical and commercial scale.

In 1937 the world's first full width commercial electrotinning line was installed at Gary Tin Mill (now United States Steel Co.). Its capacity was in the neighborhood of 50,000 tons of tinplate per year and the production was used almost entirely for dry packs. To brighten the tin surface, the strip was scratch brushed with rotating wire brushes but the product was not readily soldered. In 1941, high frequency melting equipment was installed in the line and a flow-brightened product with good solderability and corrosion resistance was made available for containers of all kinds. This pioneer line was the forerunner of the U. S. Steel Corporation "Ferrostan" or acid electrolytic lines.

In 1941 Crown Cork and Seal Company put into production an electrolytic line capable of handling material up to 30 inches in width and having the same capacity as the Gary line. An alkaline sodium stannate electrolyte and different type of handling equipment was used in this operation.

Also in 1941, Weirton Steel Company, and later Republic Steel Corporation, installed equipment different from both of these. Their lines employed a chloride-fluoride electrolyte developed by E. I. Du Pont de Nemours & Company and the steel plate was coated while moving horizontally on the surface of the electrolyte. This process is best known as the "Halogen Line."

Spurred on by the need for tin conservation, every tinplate producer in the United States started the construction of continuous electrotinning lines and by the middle of 1943, 25 lines were in operation. Both U. S. Steel Corporation and Crown Cork and Seal Company licensed various companies to use their particular processes. Schematic drawings of the three electrotinning processes are shown in Fig. 1.

Electrotinning of tinplate has now reached an advanced state of development. Most of the original lines have been modernized and capacity increased. Some of the larger and more recent installations are capable of producing 200,000 tons of 36 inch wide tin plate a year at plating speeds up to 2,000 feet per minute.

Each of the electrotinning processes has its advantages and disadvantages. The alkaline process is easy to handle in ordinary mild steel equipment and cleaning before plating is aided by the alkali in the electrolyte. The solution, however, must be heated and current densities are limited to 50 to 60 amp/sq ft. Conductor rolls carry 4000 to 5000 amperes. The "Ferrostan" electrolyte requires acid resistant equipment, alkali and acid precleaning is important and the solution is more complex. It has the advantage that only one half as many amperes are required to deposit the same amount of tin as compared to the alkali bath and with better plating efficiency. Much higher current densities, upward of 400 amp/sq ft, are used and conductor rolls frequently carry

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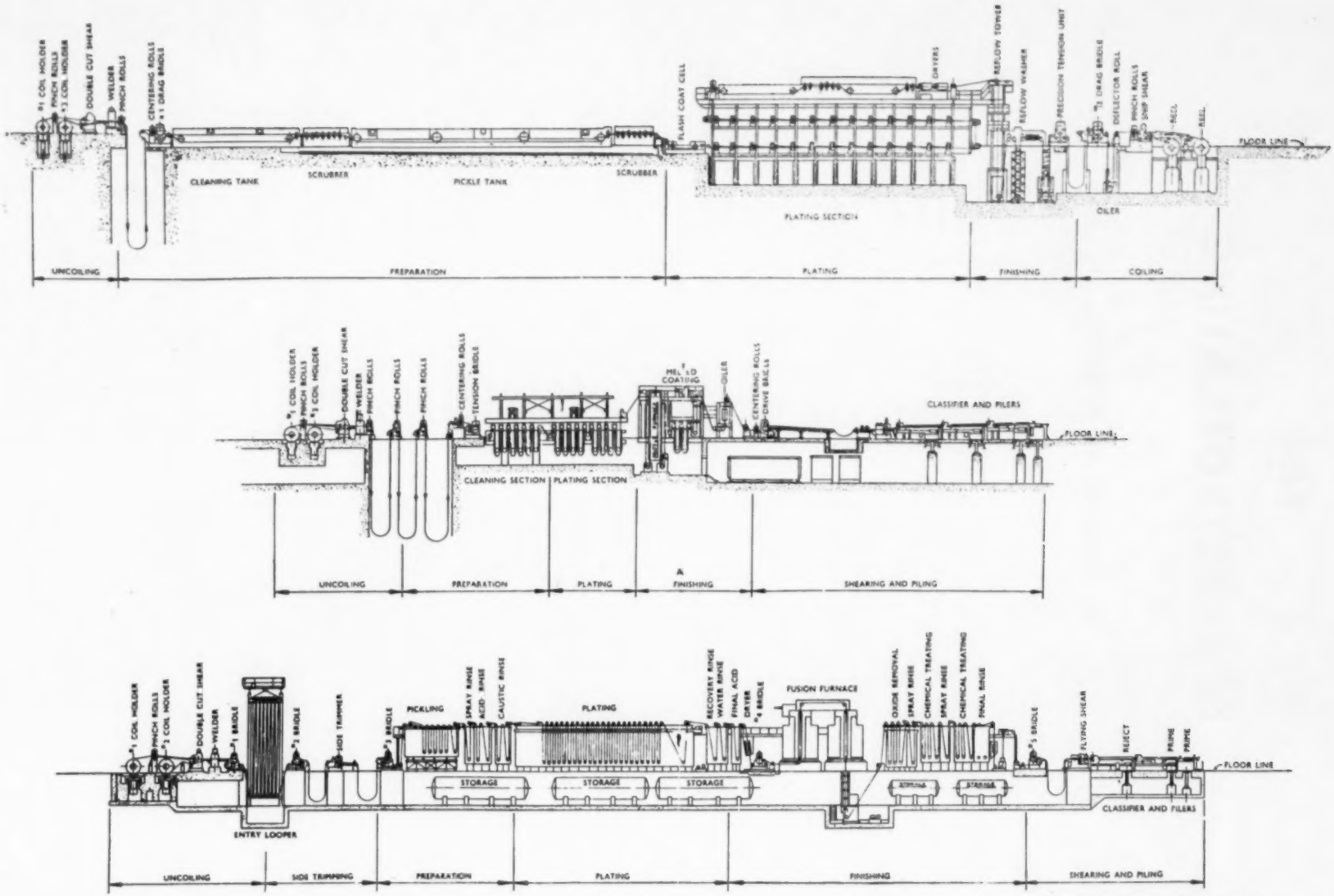

Courtesy: Wean Engineering Company, Inc.

Fig. 1. Schematic diagrams of the three general types of electrolytic tinplate line. The upper diagram is a horizontal acid or "Halogen" line; the middle diagram is a vertical acid or Ferrostan line; and the lower one is an alkaline line.

up to 15,000 amperes per roll. The solution can be operated at room temperature. The "Halogen" lines operate at cathode current densities in excess of 500 amp/so ft and the main difference between the acid lines is the greater speed of the horizontal line (Fig. 2). Complete stoppage of the process has more of an effect on the alkaline lines since in this process the essential film on the anodes is removed and more plate is damaged before the film is reformed.

The entry end of all electrolytic tinning lines is provided with two coil holders, a shear and seam welder. Thirty thousand pound coils are welded together and while the entry end is stopped for about 10 seconds, about 120 feet of slack strip is fed from a free hanging loop in a pit approximately 70 feet deep to keep the processing section running at a reduced speed of 500 ft/min.

The electrolyte and anodes in both types of acid line are contained in small individual cells and the electrolyte is continually circulated from tanks in the basement. In the horizontal line the anodes are located underneath the strip on each of two levels and in the vertical line the anodes are placed on both sides of the strip. The electrolyte for the alkaline lines is contained in a large tank, over which the conductor rolls are mounted, and is not recirculated but the solution may be dumped into a storage tank during shutdown periods.

Anodes for the acid lines are relatively small and are held in accurate position with regard to the strip. Anodes for the alkaline line are extremely large, weighing over 2000 lb. and heavier on new lines and are changed about once a month. This means that a sizable fortune is tied up in anodes on each line. Electrical requirements for the new lines have increased from 60,000 amperes to as much as 180,000 amperes for each line.

The electroplating processes are so versatile that different coating weights can be applied to each side of the steel sheet. So-called "differential plate" has recently become popular. The more heavily coated side, 60 millionths of an inch thick, meets rigorous requirements in contact with materials inside the container. The more thinly coated side, 15 millionths of an inch thick, is used on the outside which is paper covered or lithographed, and this provides an overall saving in tin.

The importance of electrodeposition in tinplate production, which got its real start in 1941, is enormous. Five million tons of tinplate are produced annually in the United States and 85 per cent of this production is made on about 38 continuous electro-tinning lines. The United States uses about 27,000 long tons of tin annually in the production of electrotinplate. Several new electrolytic installations are in operation in Europe and other parts of the world.

Electrodeposited tin and tin alloy coatings have made great inroads into other industrial fields especially in the plating of electronic components and automotive parts. Some years ago, the finishing plant or plating department was given the poorest plant location and operated on the smallest budget. This situation has now changed to the point that the well organized plating department, skilled in the electrodeposition of all sorts of metal combinations, may control the quality of the product. Plating equipment and processes have developed side by side so that it is not uncommon to see large semi-automatic and fully automatic installations in service for tinplating piston rings (Fig. 3), refrigerator evaporators, radio chassis, condenser cans and bearings, and printed circuit boards. Barrel tinplating of copper, brass and aluminum connectors in all shapes and sizes is an everyday

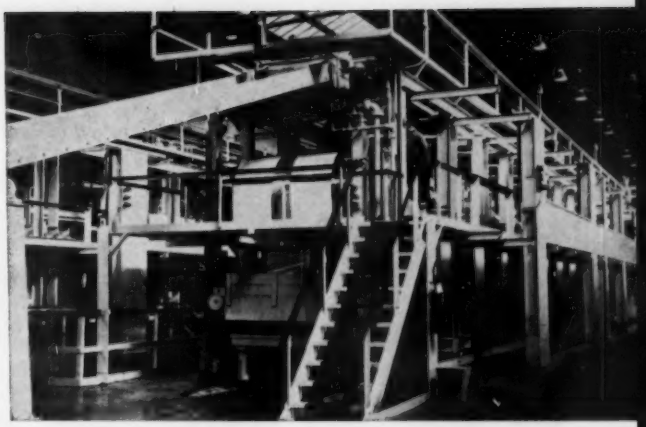

Fig. 2. Continuous electrotinning of steel sheet.

experience in most of the electronic manufacturers' plants and job shops throughout the country. Platings are supplied to rigid specifications for each application. Where solderability and long shelf life is required, a tin coating 0.0003 inch or thicker meets all the requirements. A great deal is known about the possibility of preventing galvanic corrosion by plating the basis metals. For example, satisfactory performance is obtained when there is contact between tinplated copper and aluminum, tinplated copper and nickel-plated copper, tin-plated copper and solder-dipped copper, solder-dipped copper and tinplated aluminum, copper and tinplated copper, silver-plated copper and tinplated copper, and gold-plated copper and tinplated copper. We also know that tinplated aluminum in combination with either copper or silver-plated copper or gold-plated copper will cause possible galvanic corrosion in moist atmospheres. A great deal of use is now made of duplex coatings for added corrosion protection and among these are combinations of tinplating over electrodeposited nickel or copper.

Tin coatings may also be applied to aluminum alloys and to copper and brass by a simple immersion in alkaline stannate solutions. Immersion tinning is essentially electrolytic although an outside source of current is not used.

The major automobile companies utilize this method for tinning aluminum alloy pistons used in internal combustion

Fig. 3. Electrotinning piston rings.

Fig. 4. Automobile assembly line showing pistons plated with tin.

Fig. 5. Watch parts plated in tin-nickel.

engines (Fig. 4). A fairly heavy tin coating is applied and since the tin has lubricating qualities, it provides improved performance during the running-in period.

A thin immersion tin coating provides a measure of protection to copper and brass which is subjected to mildly corrosive conditions. An uncoated brass pin will produce a black stain on textile materials and this staining is prevented by immersion tinning the pins. The immersion process is particularly advantageous for the tin coating of copper and brass tubing. The thin tin coating on the inside of the tubing prevents copper pick-up when the tubing is used for water coolers and refrigerators.

Tin alloy plating processes have been improved in the last ten years into simple plating procedures and the number of industrial applications is rapidly increasing.[5] Seven tin alloy combinations, viz: tin-copper, tin-lead, tin-zinc, tin-cadmium, tin-nickel, copper-tin-lead, and copper-tin-zinc, are being used commercially. Each of these alloy electroplates (usually in fixed composition ranges) has some particular advantage over the single metal electroplates. In general, tin alloy coatings are denser and harder, more protective to the basis metal, brighter or more easily buffed than the single metals and can be deposited over a wide range of operating conditions. Red bronze (5–20 per cent tin) is an excellent undercoat for nickel chromium plating. Tin-zinc (20 per cent zinc) is a sacrificial coating to steel, and has outstanding solderability which makes it readily acceptable for coating radio and TV parts. The bright tin-nickel coating (35 per cent nickel) has exceptional corrosion resistance and is well suited for the plating of surgical instruments, drawing instruments and balance weights. Its low frictional and non-magnetic properties are particularly useful as a plating for small watch parts in a barrel operation (Fig. 5). Tin-lead plating is used on printed circuit boards, electronic components and bearings.

A recent development of the Tin Research Institute makes possible the electrodeposition of bright tin coatings.[6] The usual processes result in a matte surface and where a bright coating is desired, the matte surface is "flow-brightened" by heating to just above the melting point of tin. The bright plate is achieved by adding small quantities of wood tar to the plating bath. The process has now reached the commercial stage with the marketing of a suitable tar brightening agent. Electrical components, domestic equipment such as refrigerator shelves and trays, wire mesh work for strainers, food handling machinery parts are suggested applications for bright tin coatings.

The fine array of modern plants and increasing knowledge of the technical processes for electrodepositing tin[7] and tin alloys guarantees continued expansion and consumption of tin in new outlets in the next few years.

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He is a graduate of the Royal Technical College, Glasgow, Scotland and Brooklyn Polytechnic Institute. As chief chemist and acting manager of the Guggenheim Research Laboratories in New York from 1926 to 1941, he was engaged in metallurgical research dealing with the purification of tin ores, the development of flotation reagents, and was responsible for a process for the recovery of sulfur from smelter smoke. From 1941 to 1949 he was a supervisor in the Analytical and Non-Ferrous Divisions of Battelle Memorial Institute.

Mr. MacIntosh is a member of ACS, ASM, ASTM and Phi Lambda Upsilon.

PRECIOUS METALS

by EDWARD A. PARKER*

GOLD WAS ONE OF THE FIRST metals to be plated by the use of an outside source of current. Plated gold items have been reported in the Egyptian tombs but they usually turn out to be "fired on" coatings.

In England silver appeared in the electroplating field at the same time as gold. The platinum metals however were quite slow to find uses as electroplated coatings.

Up to the last few years all of these metals found their greatest use in the electroplating of jewelry and other decorative items. In the past ten years however, their utilitarian properties, corrosion and wear resistance and electrical conductivity have come to the forefront in the rapidly expanding electronic and communication industries.

GOLD

THE ELECTRODEPOSITION of gold from a solution of "ammoniates of gold" and potassium cyanide on silver was reported in 1805 by Professor Brugnatelli of the University of Pavia (Italy) in the journal Bibliotheque.

In the following year C. J. T. de Grotthuss[2] published work on the deposition of gold, platinum and several base metals from the "nitro-murates."

In the next twenty years there were many in Switzerland who repeated Brugnatelli's work with varying degrees of success.

In England no mention of electrodeposition occurred until 1837–40 when Jacoby, Spencer and Jordan all published and discussed their claims to the discovery of electrodeposition.

In 1840, the Elkingtons[3] of silver fame received the first English patent on the deposition of gold from a solution of gold oxide in potassium cyanide at room temperature. Sometime in this period (1838–41) the Watt[4] brothers developed a gold plating bath containing sulfide which they still claimed gave excellent results in the 1889 edition of their book "Electrodeposition."

Alfred Smee's[5] book on electrometallurgy in 1841 summarized not only his own extensive work on gold, platinum silver, lead, etc., but outlined all the principles which were of immeasurable service to everybody in the field.

The use of thiosulfate as a brightener in a gold bath at 100F was first proposed by Poole[6] in 1843. Roseleur[7] first described the use and advantages of phosphates and sulfites in gold solutions. Roseleur[8] also recommended the addition of 1.3 ounces of sodium sulfide per gallon of gold solution to improve its plating characteristics at 150 to 170°.

In general, dilute solutions were used hot, over 150F, and concentrated solutions, one ounce of gold or more per gallon, were used below 110F.

Work on practically all the other possible salts was published in these early years and may be found[9, 10] in Watt, Langbein, Frary.

Alloy gold plating was usually passed over in a page or two in all the above books with such statements as to add copper solution until the plate is red enough. One exception to this very general information was a patent by Record.[11] He added five ounces of nickel sulfate to a solution containing one ounce of gold. Claims were for a harder plate and reduction of the amount of gold plate required for a given wear resistance.

Even in the early days, before 1880, Watt[12] and others recognized that small amounts of certain organic contamination brightened the plate and that large amounts of all kinds produced "dead," "streaked" or dirty plates.

Very little new appeared in the literature until the 1930's when the Bek[13] process was brought forward. In essence, a fairly heavy layer of gold or a high karat alloy was plated and then heat treated to form a hard diffusion alloy of proper color and average karat. Newly enacted marking laws for jewelry, watch cases, etc., however, soon prohibited use.

A more direct process for plating gold alloys was the Winkler[14] or Awidur process. A typical example was to progressively plate at 2, 8 and 40 ASF in succession and then repeat the cycle two to 100 times per minute, which could be called pulsating dc plating. Only a few attempts were made to use it in this country but in Germany it was the start of the 17K red gold electroplates for watch cases.

The development of radar in World War II led to an increased demand for heavy electroplates of 24K gold. About 1950, the use of heavy 24K began to increase and is increasing at an accelerated pace at the present time. The three major reasons for its use at the present time on electronic and communication equipment are:

(1) resistance to tarnishing or corrosion;
(2) ability to withstand push-pull or back and forth wear plus a definite period in a corrosive atmosphere and then have a low electrical resistance;
(3) resists high temperature.

One of the most important points in securing good corrosion resistance with any plated metal is the preparation of the surface. As the quality of the basis surface decreases—pits, scratches, etch pits or inclusions—the corrosion resistance of the best electrodeposit laid down under optimum plating conditions for that solution will decrease rapidly.

Hardness measurements are not necessarily an indication of wear resistance. Such measurements are actually an indication of its resistance to cold deformation. A plate that is hard because of stress or brittleness will not wear well. Under pressure small particles will break off causing rapid wear. If any of these then become lodged in the rider the plate will gouge still more rapidly.

The following two general formulas have proved of value in plating 0.000020 to 0.001 inch:

	Rack	Barrel
Potassium carbonate	4 oz	4 oz
Dipotassium phosphate	4 oz	4 oz
Potassium cyanide	4 oz	4 oz
Gold as potassium gold cyanide	1 troy oz	½ troy oz
Make up to 1 gallon		
Temperature	130–150F	130–140F
Current density	1–10 asf	1–5 asf
Agitation	Preferred for higher amperage.	
Anodes	304 or 316 stainless steel—area equal to cathode or larger.	

* Technical Director, Technic Inc., Providence 1, Rhode Island.

Picture Courtesy of Cohan-Epner Company, New York

Plating shop of a half-century ago. Picture taken in 1903 of the plating plant of Joseph Landsman, right, at the gold plating "tank." Louis Epner, left, operating the jewelry polishing lathe, and Emanuel Cohan, center, cleaning prior to plating, formed their own plating business in 1911.

In all cases it is best to use a weak gold strike (2–5 dwt gold and 3–5 oz free potassium cyanide per gallon) to provide fast, complete coverage before entering a heavy gold plating solution. In addition to the fast coverage a strike solution serves two other purposes, eliminate (1) drag-over of dirty rinses or prior plating solutions and (2) contamination of the concentrated solution by attack of the basis metal or plate by the hot cyanide solution before it is covered with gold.

If any kind of care is taken in the operation of these solutions the gold plate will assay 99.8 per cent or higher, (23.95 + K). If any appreciable quantities of other metals do plate out due to badly contaminated solutions, the plate is decidedly off-color and in most cases will tarnish rapidly. This also applies to operating outside of the normal ranges.

In the production of very heavy plates, 0.010–0.1 inch, the acid chloride bath[15] is still preferred. Two precautions must be observed, (1) the item must first be coated with 0.0002 inch of cyanide gold to prevent attack by the strong acid and (2) that the metal content be over two ounces per gallon.

Decorative

In the decorative or jewelry field the gold coatings are extremely thin, two to seven millionths inch. With only a few exceptions, all the gold plates are alloys. Solutions contain two to five pennyweights gold per gallon. Alloying metals added as standard concentrates of the double cyanides are nickel, cobalt, silver, cadmium, copper and zinc. Tin is usually added as the stannate. Temperatures are maintained at 130 to 180F. Voltages are in the range of 4 to 10 volts. Free cyanide may vary from 0.01 to 5 ounces per gallon. For a solution to stay in continuous use over several years all the above factors must be controlled and replenishment, determined by analyses, be made on a definite schedule. Filtering and occasional carbon treatment are also necessary to eliminate sources of trouble. More complete information on the various factors is given in a separate article.[16]

Industrial Alloy Plating[17]

With further developments in the electronics and allied fields, other properties became important and alloys of gold had to be developed to meet these requirements.

Small quantities (20–50 mg antimony per gallon) of a soluble antimony salt added to the formulations given under the Industrial 24K gold (on previous page) produced alloy plates (0.1–0.5 per cent antimony) which were then heat fused to germanium wafers. The combination fitted with leads then became an "n" type semiconductor.

The addition of one to two grams of indium to the same type of gold bath will produce the opposite type, namely "p" semiconductor.

In certain type of sliding contacts, 24K gold will tend to "gall." It has been found that the addition of small amounts of nickel or cobalt will eliminate this characteristic and at the same time materially harden the plate. Practically all the applications were in barrel plating of small connectors. The addition of one to five grams of nickel to the barrel 24K listed previously, after sufficient aging, will produce the desired results. For thin coatings (0.000010 inch) the gold content may be reduced one-half to one-third but if it is attempted to plate heavy from such a solution, the plate will be porous, have poor color and tend to have poor wear resistance.

For plates thicker than 0.000020 inch, the maximum nickel content in a good electroplate is two per cent.

In the printed circuit field and others the addition of a small amount of silver has allowed plating to proceed at room temperature and the free cyanide can be maintained in any desired range from less than 0.1 to 15 ounces per gallon. Silver is more noble than gold in this solution and thus plates faster than gold for equal concentration. Agitation also will increase the ratio of silver to gold in the deposit.

With one ounce of gold or less in the solution, it is necessary to use agitation in order to get bright plates. Gold contents of thirty pennyweights or more make it possible to plate without agitation, a desirable feature in many cases.

In barrel plating with this combination it is best to reduce both the gold and silver and to use a very high ratio of conducting salts to obtain good throwing power and uniformity.

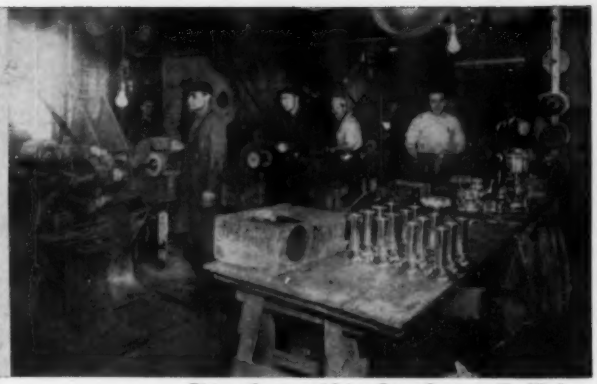
The operation of both of these solutions above 100F will give semi-brite or slightly mat plates but many of the physical properties are improved, such as ductility, freedom from stress and lower silver contents for a given set of operating conditions.

The European watch industry has for some years produced heavy red golds with a fairly well fixed gold content of 17K (71 per cent gold). A new development in this field is the neutral gold bath.[18] Monopotassium or ammonium phosphates are used to reduce the *p*H to 6.5–7.5. The rate of deposition of copper is increased considerably and most of it is in solid solution with the gold thus reducing the rate of tarnishing for a given copper content. In high cyanide or high *p*H solutions, the copper appears to plate out in discrete increments or islands and thus the areas of pure copper tarnish rapidly even with only five per cent copper in the alloy.

Future

There has been a general trend toward the reduction of cyanide content in gold solutions. First, there was the reduction of *p*H to 9–10 for plating on printed circuits. This left a trace of free cyanide. The work of Volk[18] and Raub[18] reduced the *p*H to 7.0, eliminating all trace of free cyanide.

Precious metal plating at the Cohan-Epner plant of 1928.



Pictures Courtesy of Cohan-Epner Company, New York

Typical buffing and polishing room of 30 years ago.

It is now known that many solutions of gold salts or complexes are stable on the acid side. Even the cyanide complex solution can be acidified with most of the mineral acids and the strong organic acids to a *p*H of 3.0 and remain stable for some time at room temperature. Decreasing the *p*H further, however, will produce rather rapid hydrolysis and precipitation of the gold. The reaction increases as the temperature increases or the *p*H is decreased further.

Rate of deposition decreases rather rapidly as *p*H is decreased. In the *p*H range of five to seven the current efficiency is over 90–95 per cent at normal current densities and gold concentrations. At a *p*H of three current efficiencies are down to 10 per cent even for high gold contents.

At present there are several solutions on the market which operate in the *p*H range of three to five. Current densities are fairly high compared to equivalent gold cyanide solutions. It is also apparent that the range of possible alloys is much greater than in the cyanide solutions.

Physical properties appear to be improved for certain applications. Grain structure is finer and porosity is reduced. Hardness is much greater for an equivalent gold content.

The activity in the field of gold and gold alloys is the greatest it ever has been since the tremendous activity in the 1840–1850 period.

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SILVER

THE ONLY PRODUCTION plating bath for silver is the cyanide complex. Its discovery is generally credited to G. R. and H. Elkington[1] of Birmingham, England, who received a patent for the process in 1840.

Within two years Sumner Smith[2] announced his "discovery" of the "Art of Gilding and Silvering" in the Hartford Times. After his death, it was found that he was a subscriber of the Journal of the Franklin Institute which had published lengthy accounts of the discoveries of the Elkingtons. His "invention" soon passed through several partnerships and ended up in the hands of the famous Rogers Bros., in 1846, who were the basis for most of the trademarked lines of the International Silver Company.

The first and most important brightener up to approximately twenty-five years ago was carbon disulfide and was patented in 1847 by Milward and Lyons.[3]

During this initial period, 1835–1855, there were numerous publications[4] describing the other electrolytes and/or brighteners for silver plating. Actually, no new electrolytes, except sulfamates, have been proposed in the intervening years. Many have been reinvestigated but with very little success in developing a production process. No suitable acid electrolytes have been developed but there is a definite need for one at present.

The next seventy years produced no new information. In fact, one is led to the conclusion that interest stagnated and progress was in the reverse direction.

The wide use of thiosulfates as a brightener in silver solutions in the period 1930–1950 was rediscovered by L. Pan[5] in 1931.

Extension of the sulfur brighteners to the organic derivatives such as thio ureas, semi-carbazides and thionyl carbamic acid was reported by Egeberg and Promisel.[6] Numerous variations were then patented in the next fifteen years.

All these brighteners did not give truly bright mirror reflecting surfaces. The great value was in the production of smooth semi-bright plates, which were fairly easily buffed to mirror brightness.

Along in the late twenties and early thirties, it began to be

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realized that the addition of carbonate to a new solution improved the throwing power[7, 8] and "ironed out" many of the difficulties which always were inherent with a new solution.

Heavy Deposition

The development of the silver plated bearings for aircraft in World War II provided the first really concerted effort on the problem of high speed heavy production plating of silver.

The following solution by Hart and Heussner[9] was typical of this period:

Silver, as silver cyanide	10–12 tr oz/gal
Free potassium cyanide	12–15 oz/gal
Potassium carbonate	2–15 oz/gal
Potassium hydroxide	4–6 oz/gal
Ammonium thiosulfate	0.02 ml/gal
	Added every 15 min
Anti-pit-H_2O_2	0.02 ml/gal
	Added every 30 min
Temperature	110–130F
Current density	60–150 asf
Constant filtration	
Vigorous agitation	

Schaeffer[10] preferred a more dilute solution.

Both papers list procedures for plating 0.010 to 0.1 inch silver on steel. In addition, the Hart and Heussner article reports the effect of annealing at various temperatures on the hardness and tensile strength of the plated silver coating.

The tensile strength as plated is 48,000 psi. As the annealing temperature is raised to 500F in air or hydrogen, the tensile strength rapidly drops to 25,000 psi. In hydrogen the tensile strength remains constant at temperatures above 500F. In air, however, temperature above 1200F produces a further rapid drop in strength.

Present Day Practice

Present silver practice varies with the application. Concentrations run from two to 18 ounces of metal per gallon. The largest number of users, however, use one of the more recent bright silvers. The following general formulation covers the bright silvers:

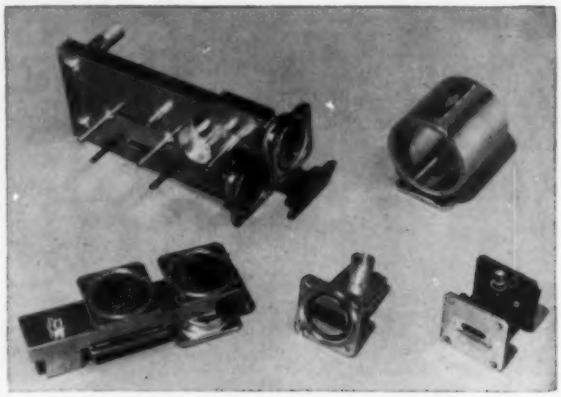
Silver cyanide	7 oz/gal
Potassium cyanide	15 oz/gal
Potassium carbonate	6 oz/gal
Silver	5 tr oz/gal
Free potassium cyanide	10–12 oz/gal
Current density	3–20 asf
Agitation	Preferred
Temperature	70–100F
Anodes	99.99 +

The range of thickness plated is 0.0001 to 0.005 inches. The applications run from silverware to complicated electronic equipment.

The first of the new brighteners was that of Kardos.[11] The primary brightener is the alkaline soluble portion of the condensation product of carbon disulfide and modified ketones. The secondary brightener is Turkey Red Oil (sulfonated castor oil). This latter product has appeared in quite a few patents for bright silver.

Fisher[12] employed a similar product, the alkaline reaction product of carbon disulfide or xanthate with acrolein.

The second type of brightener was an antimony or bismuth glyceride in a tartrate-free solution patented by Greenspan.[13] A prior solution[14] used two to 15 per cent antimony to produce a very hard, smooth silver plate for a special application.



Industrial precious metal applications. Gold and rhodium plated waveguides and microwave components.

Ostrow[15] used the selenium analogues of the prior sulfur brighteners, i.e., selenocyanates, selenoureas, selenophenols, selenides and selenosulfites, together with antimony and a wetting agent.

The above solutions are also used quite successfully for barrel plating.

Those who desire a thin silver base for oxidizing or other coloring prefer a dilute solution about one-half the above strength and no brighteners.

For the very heavy plates, greater than 0.003 inch, formulas similar to that of Hart and Heussner are used. This same solution is also used for very high production barrel plating.

In all of the above solutions, periodic reverse may be used to (1) operate at higher current density; (2) omit agitation; (3) obtain more uniform deposits on difficult shapes, or (4) to plate to heavier thickness than normal. It is to be understood that only one of these advantages may be obtained at a time. The cycle is approximately 10–12 seconds direct and one to two seconds reverse. Periodic reverse is of no value in barrel plating, although pulsating dc may be of some value.

Preplates

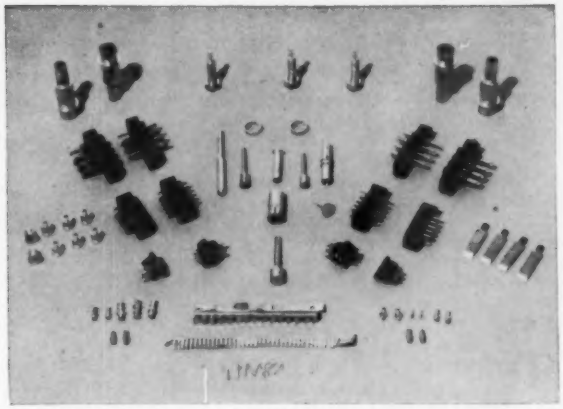
In order to plate most basis metals, it is necessary to "strike" in a low silver, high cyanide bath to prevent immersion deposition and subsequent plates with poor adhesion.

Silver cyanide	0.5–0.7 oz/gal
Potassium cyanide	10–12 oz/gal
Temperature	70–90F
Current density	10–30 asf
Time	10–30 seconds

For direct plating on steel it is advisable to flash copper from a rochelle copper or to use a combined silver-copper strike followed by the above standard strike before entering the regular plating solution.

If the item is to be heated over 900–1000F the copper strike is replaced with a nickel strike. The diffusion alloy of copper and silver is quite brittle.

Nickel alloys, even nickel silvers, are usually given a strike in the standard nickel chloride solution, followed by the standard silver strike.



Gold, rhodium and palladium plated connectors, terminals, contactors and miscellaneous electronic components.

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PLATINUM

THE CHLORIDE BATHS were first tried in 1840. Many variations were reported; some with a large excess of acid and others neutralized and complexed with ammonium salts, but in general all gave poor results.

The phosphate baths were next tried and have borne some of the best known names in the field. Roseleur[1] received a French patent in 1847. Pilet[2] received another French patent in 1885 and then Pfanhauser[3] in 1914 proposed a similar bath.

Current efficiencies were low and these baths were suitable only for extremely thin plates. All the above baths were made with platinic chloride, diammonium and disodium phosphates. Temperature was over 190F and current densities were less than 10 asf.

In the early period 1850–90 Boettger[4] developed an organic salt bath for platinum. Approximate concentrations were 1.3 pounds of sodium citrate and 2.5 ounces of platinic chloride per gallon. Wahl[5] in 1890 worked with a slightly acid oxalate bath, namely one ounce of platinic hydrate and 4 ounces of oxalic acid made up to one gallon. It was maintained on the acid side with frequent small additions of oxalic acid.

In 1930 the first of the amino-nitrite patents was granted to Keitel and Zschiegner.[6] For flash plating the following dilute bath was preferred:

Platinum as the diamino dinitrite	10 g/gal
Ammonium nitrate	13 oz/gal
Sodium nitrite	1.5 oz/gal
Ammonium hydroxide	200 ml/gal
Current density	30–100 asf
Temperature	205–215F
Anodes (Insoluble)	Platinum

The water insoluble platinum diamino dinitrite is converted to the soluble tetraamino dinitrite by boiling in five per cent ammonium hydroxide.

In the production of heavy plates, 0.0001–0.001 inch, it is preferred to raise the platinum concentration to 30 to 40 grams per gallon and operate at a current density of 30 to 50 asf. Other operating details remain the same as the above dilute formula.

Faust[7] and his co-workers improved the plate characteristics of this bath (40 grams/gallon) by the introduction of a periodic reverse cycle of five seconds direct and two seconds reverse. At 50 asf, 0.0002 inch was plated per hour. The major advantage was that a 0.0002 inch plate over nickel withstood boiling hydrochloric acid for 5 hours with no weight loss. Without periodic reverse the 0.0002 inch coatings failed in a few minutes in boiling 20 per cent hydrochloric acid.

No etching or stripping takes place on the reverse cycle; however, depolarization of the plate does occur and is credited for the greatly decreased porosity and increased smoothness of plate.

Plates were made as thick as 0.0015 inches with indications that thicker plates could be made with satisfactory properties.

A mildly caustic bath has been used in England.[8, 9] In skilled hands, this bath gives excellent results, but has not found much use outside of the originating laboratories.

At the other end of the *p*H range several acid baths have been described. The first mention was in Langbein.[10] The second was by Keitel, but reported by Kushner.[11] It consisted of 12 grams of platinum as the diamino nitrite and 300 ml of phosphoric acid per gallon. Operating conditions are 140F and 2-3 volts.

The latest one is a strong hydrochloric acid solution by Atkinson[12] and is patterned after the gold chloride bath, namely 75 grams of platinum as the chloride and 800 ml of hydrochloric acid per gallon. Operating data are 140F and 30–40 asf with uniform agitation. Its major defect is that all metals must have a substantial coating of a precious metal or serious chemical etching will occur.

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PALLADIUM AND OTHER PLATINUM METALS

Palladium

THE EARLIEST EXAMPLE of palladium plating[1] is an item in the Perry Collection in the Science Museum, London, England, dating back to before 1855. Smee,[1] one of the first to discuss palladium plating, recommended in 1841 an ammoniacal solution of the "ammonio-muriate of palladium" for the best deposition of palladium.

There was little interest in the commercial use of this metal until the 1930's. The first well known bath was the phosphate bath of Pilet[2] which was similar to his platinum bath.

The next well established formula was that of Keitel and Zschiegner[3] with the introduction of the diamino-nitrite salt which had worked so well in the platinum bath.

Ammonium nitrite	12 oz/gal
Sodium nitrite	1 oz/gal
Ammonium hydroxide	200 ml/gal
Palladium as diamino nitrite dissolved in dilute ammonia	15 gr/gal
*p*H	7-8
Current density	5–10 asf
Insoluble anodes	Platinum or palladium

Replenish with the diamino nitrite salt dissolved in ammonia. This bath is recommended only for thin plates.

The next step was the strongly acid solution of Wise and Vines.[4] It was analogous to the gold and platinum acid chloride solutions and all basis metals require a substantial plate of a precious metal, such as gold, palladium or platinum from a non-chloride bath.

Palladium chloride	320 g/gal
Hydrochloric acid	250 ml/gal
Ammonium chloride	5 oz/gal
*p*H	0–0.5
Temperature	120–140F
Anodes	High purity palladium
Pd	200 g/gal
Agitation	Preferred

Heavy ductile plates are obtained once the basis metal is completely covered with palladium.

The amino nitrate[5] bath is reported to give good results in England but no known use is made of it in this country.

To complete the *p*H range a strong caustic bath has also been used.[6]

Silver is the preferred basis metal. Plates on nickel usually have poor adhesion. If the palladium plate is to be oxidized, colored or subjected to high temperature it is best to bake at 350–400F for 30 minutes to eliminate absorbed hydrogen.

Ruthenium

Ruthenium was not discovered until 1845 by C. Claus. Practically no mention was made in plating literature until Zimmerman and Zschiegner patented[7] the nitroso-chloride bath. Volterra[8] developed and patented the sulfamate bath for the plating of electrical contacts. Good quality plates 0.0001 inch thick are obtained, which are said to withstand high intensity arcs.

Iridium

Iridium has only been plated from a molten cyanide bath.[9]

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RHODIUM

THE PLATING OF RHODIUM is quite recent. The first commercial plating was in the jewelry field in 1930 from the phosphate and sulfate baths.

The metal itself was first isolated in 1804 by Wollaston from Columbian platinum ores. It did not become readily available until the 1920's when it was found that it could be separated from the anode slimes in the electrolytic purification of nickel in the Sudbury-Canada area and Rustenburg, South Africa.

The first papers on the deposition of rhodium were by Joly and Leidre,[1] E. F. Smith[2] in 1891 and Langness[3] in 1907. Their primary interest was for analytical purposes.

The first patent was obtained by P. Marino[4] in 1913. The bath was composed of sodium rhodium chloride, magnesium borocitrate and a glucocitrate.

The next patents were on the nitrite baths. Zschiegner[5] and Keitel[6] applied for the first ones in 1927. Even though they[7] stated in 1931 that the nitrite bath was not being used commercially because of its low solubility, its low current efficiency and high temperature required, a large number of patents were granted for variations of this bath in the next ten years.

The jewelry field had been looking for many years for a very white corrosion resistant finish. Plated white golds always had a yellow tint. The other white metals—nickel, tin and chromium, all had their drawbacks. With the discovery of the phosphate and sulfate baths for rhodium in 1930[8] the whole industry converted to its use in less than a year.

In the next few years articles by Cinamon,[9] Fink,[10] Atkinson and Raper,[11] Grube and Kesting[12] and Weisberg[13] discuss experimental work with the phosphate and sulfate bath and its advantages over other electrolytes.

With the exception of reflectors and some scientific equipment, the decorative aspect of rhodium in the jewelry field remained the primary use until World War II.

With the war years the development of new communicative and control equipment set very high standards for contact performance at high frequencies and also required that the equipment remain operative under severe service conditions.

Rhodium was ideally suited for most of these applications due to the following properties:

1) High wear resistance
2) High corrosion resistance
3) Good electrical conductivity

The wear resistance is due mainly to the extreme hardness of the plate; 800 diamond pyramid.

Rhodium is resistant to all acids including aqua regia.

Rhodium plated printed circuit switches and commutators.

Fuming sulfuric acid at 300C will attack rhodium sponge but not the compact metal. The so-called tarnishing of rhodium plate is due to the porosity of the usual thin plates in use. Therefore, to obtain adequate protection without using thick coatings, the undercoat must be chosen to fit the environment. Thus for a marine test, silver is a better undercoat than nickel. For atmospheres of sulfide or acid, nickel is the preferred basis plate.

The electrical conductivity of rhodium is twice as good as platinum but only 38 per cent that of silver. However, silver and most other metals, oxidize or tarnish readily and make for increased contact resistance with consequent poor conductivity. Rhodium, on the other hand, does not oxidize at normal temperatures and thus its contact resistance remains constant and reproducible over long periods of time.

Rhodium plating is extensively used for reflectors because of its excellent non-tarnishing property. Initially, the reflectivity for rhodium is 75 per cent that of silver in the visual range but silver will tarnish rapidly and lose its optical reflectivity.

The following two baths cover most of present day applications: (1) Decorative (jewelry) and Industrial Flash Deposits

Rhodium (as phosphate or sulfate)	5–10 g/gal
Acid (sulfuric or phosphoric)	100 ml/gal
Temperature	100–120F
Current density	10–80asf
Agitation	Optional
Anodes	Platinum

In the jewelry field the phosphate bath is preferred. Sulfuric acid is quite reactive on any exposed base metal such as iron (knife blades, springs, etc.), tin alloys and the other casting metals which are prevalent in this field. It is also claimed by many that the phosphate produces a better white with which to highlight the stones. The sulfate bath is preferred for small chain where greater throwing power is required.

For tarnish prevention requirements in indoor areas, the industrial flash plate of rhodium is approximately 0.000020 inch. The preferred bath is the sulfate and the concentration is 8–10 grams per gallon. In the printed circuit field the current densities are reduced to less than 30 asf to prevent burning on narrow leads.

(2) Heavy deposits—0.0001 inch, plus.

Rhodium	20–40 g/gal
Sulfuric acid	100–200 ml/gal
Current density	5–30 asf
Agitation	Preferred
Anodes	Platinum
Temperature	70–90 per cent with agitation
Current efficiency	50–60 per cent no agitation

As thickness requirements increase it is preferred to increase the rhodium concentration.

In connection with heavy deposition the following factors tend to reduce stress and/or brittleness in rhodium deposits:[14]

1) Increased metal concentration
2) Increased acid content
3) Increased temperature to a maximum of 130F
4) High purity
5) Extreme cleanliness and slight etch of basis metal

In barrel plating[14] for decorative purposes the metal concentration is low; four to six grams per gallon. With increasing thickness specifications the metal content of the bath should be increased, reaching a value of 15–20 grams per gallon for plates 0.0001–5 inches thick. In the case of extremely small parts, less than $^1/_{16}$ inch diameter, the perforation size in the barrel is very small and the transfer of solution very slow, the concentration must be increased to 20–40 grams per gallon for heavy plates.

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Dr. Edward A. Parker obtained his education at the University of Illinois where he received the degrees of BS in 1930, MS in organic chemistry in 1932 and PhD with thesis on X-ray diffraction in 1937. Following appointments as Textile Foundation Fellow (1935–1937), with Long Island Biological Association (1937–1939) and as Atlas Powder Fellow (1939–1941), he entered the plating field in 1941 when he joined the consulting firm of A. Kenneth Graham and Associates. He then became associated with Alrose Chemical Company, which he left in 1945 for his present position as Technical Director of Technic, Inc. Dr. Parker is an active member of the Providence-Attleboro Branch, AES, having served in the capacities of secretary-treasurer, president and on the Paper Awards Committee.

He is a member of the Research Project Subcommittee No. 12 from inception to date, the AES Scientific Achievement Award Committee, former member of the Editorial Board of Plating and the AES Research Committee; Dr. Parker received the AES Gold Medal Award in 1952.

COPPER PLATING DURING THE LAST FIFTY YEARS

by FRANK PASSAL*

INTRODUCTION

ALTHOUGH THE COMMERCIAL APPLICATION of copper plating had its origin in the early years of the nineteenth century, the most rapid progress in this field has occurred only during the last thirty years. As with the other two of the more important plated metals, nickel and chromium, the electroplating of copper for decorative and functional purposes began to progress most rapidly when a demand for the coating on a large scale in the automotive and other industries stimulated an intensified effort in the study of bath compositions and operating variables. Some of the motivating factors were the introduction of more rigid specifications and requirements for increased deposit thickness, higher speeds of plating and improved quality of deposits from the standpoint of luster, smoothness and freedom from porosity.

Parallel with these fundamental studies there also occurred rapid development of plating equipment such as tank linings, semi- and full-automatic conveyor systems, filtering devices, *p*H control instruments and dc current sources. Last but not least in improvements have been the rapid strides forward in manufacture of purer and more consistent plating chemicals and anodes, and the utilization and development of chemical and electrochemical purification procedures.

The following report covers the most significant developments in the chemistry, technology and applications of copper plating during the last fifty years. A number of acidic and alkaline plating systems will be considered, with special emphasis on the most recent developments and trends. A number of problems which still exist will be presented and discussed.

GENERAL

Although the literature on copper plating and its applications is quite extensive, there have appeared a number of excellent review articles which have served as bench marks for a periodic evaluation of progress in this field. In 1913 Bennett's[1] review article considered a variety of acidic and alkaline copper plating formulations and operating conditions. From the number and nature of heterogeneous bath compositions and additives covered in this review it is evident that the state of the art was far from stabilized at that time. Many of the bath compositions seem rather archaic and impractical in the light of present day knowledge.

The comprehensive review article of Bandes in 1945[2] emphasized the substantial progress made in the intervening 32 years. Not only had there occurred substantial improvement in bath formulations and process conditions for the sulfuric acid bivalent copper bath and the cuprocyanide system, but several new baths had been developed which were important contributions to copper plating. These were the bivalent alkaline pyrophosphate, acid fluoborate and the alkaline organic amine baths.

The informative general review articles of Lutter[3] and Weimer[4] cover most important recent developments particularly concerning the acid sulfate system and the alkaline cyanide and pyrophosphate systems. Baths giving deposits with improved leveling, buffing and luster characteristics are especially emphasized.

Of all the common metals which are plated, copper is perhaps the most unique from the standpoint of the variety of acid and alkaline systems from which it has been plated. The following is a partial list of anions in acidic media which have been investigated for copper plating:

a. Sulfate
b. Fluoborate[5]
c. Sulfamate[6]
d. Fluosilicate[7]
e. Alkane sulfonate[8]
f. Iodide[9]
g. Aromatic sulfonate[10]
h. Oxalate[11]
i. Formate[12]

The deposition of copper from the following alkaline systems has also been studied:

a. Cyanide
b. Thiosulfate[13]
c. Pyrophosphate[14]
d. Organic amine[15]

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e. Thiocyanate[16]
f. Ethylene diamine tetra acetate[17]
g. Tartrate[17a]

The relatively high solubility of copper salts in acid systems, the high cathode efficiency in copper plating down to very low *p*H values, and the ability of copper to form a number of monovalent and bivalent complex ions in acid and alkaline media are the principal reasons why investigations have been made on such a wide variety of copper plating systems.

Of the systems which have been studied, only relatively few have reached a stage of commercial importance. These are the alkaline cyanide and pyrophosphate complex ion systems and the acid sulfate and fluoborate simple ion systems. Other types of baths have been too unstable; or have been lacking in good deposit characteristics, in sufficiently wide current density range or in good anode corrosion.

In the following pages the most important acid and alkaline copper baths will be reviewed from the standpoint of bath chemistry and composition, additives, operating conditions and most important applications.

ACID SYSTEMS

A. Sulfuric Acid Copper

In 1830 Professors Wagner and Jacobi, while engaged in the investigation of the Daniell Cell ($Cu/CuSO_4/ZnSO_4/Zn$), noticed a layered deposit of copper which reproduced the form of the sides of the cell vessel. The practical utilization of this observation was communicated to the Academy of Sciences in St. Petersburg by Professor Jacobi in 1838. In 1836 De la Rue[18] while working with a form of the Daniell Cell also noticed the surface-reproducing characteristics of electrolytically deposited copper. Other investigators such as Jordan[19] in a paper entitled "Electrotype Process" read before the Liverpool Polytechnic Society in 1839, reported similar findings.

Since these early beginnings of acid copper plating, the system has been found to have increasing widespread application in the plating industry for a variety of decorative and functional uses. In one of the large automotive organizations it is reported, for example, that 560,000 gallons of acid copper are used for the plating of ferrous and non-ferrous basis metals

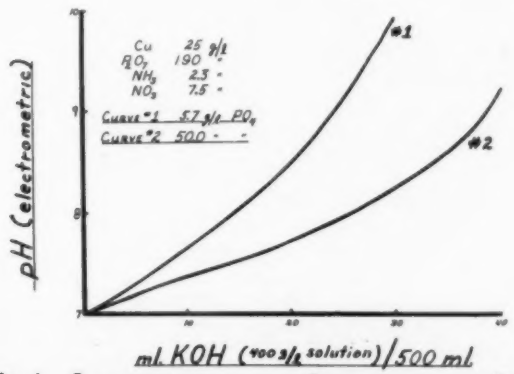

Fig. 1 Buffering effect of Orthophosphate ($PO_4^{\equiv}$) concentration in the Pyrophosphate copper plating solution

prior to polishing and buffing, and to application of other decorative deposits such as nickel and chromium.

A number of review articles on this bath have appeared in the literature.[1, 2, 20, 21] In general, the two main bath constituents are copper sulfate pentahydrate ($CuSO_4, 5H_2O$) and sulfuric acid. Although specific bath compositions suggested for a variety of purposes vary widely, the composition limits and operating conditions given in Table I are fairly representative.

TABLE I

SULFURIC ACID COPPER CONCENTRATION AND OPERATING CONDITIONS

Copper sulfate ($CuSO_4 \cdot 5H_2O$)	150 to 300 g/l (20 to 40 oz/gal)
Sulfuric acid (H_2SO_4)	10 to 110 g/l (1.3 to 15 oz/gal)
Temperature	20 to 50C (70 to 120F)
Agitation	Mechanical and air
Cathode current density	25 to 500 amp/ft^2
Anode current density	15 to 50 amp/ft^2

A wide range in sulfuric acid concentrations will be noted. The lower concentrations, i.e. below 30 g/l, seem to be most often recommended in patent literature covering the use of addition agents for brightening, grain refining, leveling, and other purposes. For reasons not exactly known the electrolyte seems to be most responsive to sulfur containing organic additives at the lower sulfuric acid concentrations. Perhaps with the lower acid contents the additives are subject to less decomposition, and greater amounts of beneficial colloidal matter may be formed in the cathode film.

It has been recognized for many years[22, 23, 24] that regulated additions of chloride to a sulfuric acid copper bath have some beneficial grain refining and related effects. Excessively high chloride contents, however, particularly in bright plating formulations, have pronounced deleterious effects in that deposits in low current density areas become duller, more grainy and off-color. It is very important, therefore, to carefully select copper sulfate of good quality, i.e. low in chloride and other impurity contents to obtain optimum and consistent results. The water used for make-up and replenishment purposes should be low in chloride or pretreated as by ion exchange to remove chloride. Organic impurities may be removed during bath make-up by treating the copper sulfate solution (before the addition of sulfuric acid) with a slight excess of potassium permanganate at 100 to 120F, followed by an activated carbon treatment (1 to 3 lb per 100 gal) and filtration.

There is a tendency in acid copper plating to obtain rough cathode deposits because of introduction into the bath of anode sludge and slime. During the last few years beneficial effects have been reported from the use of copper anodes manufactured to contain regulated amounts of additives such as phosphorus.[25, 26] These additives are claimed to favor deposit smoothness by causing the formation of anode films which retard the tendency of insoluble anode dissolution products from escaping into the bath.

A great variety of additives to the baths have been recommended for grain refinement, regulation of deposit hardness,

increasing leveling and luster, and for obtaining other specially desired characteristics. An interesting early article by Sand[27] deals with the protective colloid type of additives and their effects on brightness, periodicity and related deposit phenomena. According to Sand "bright copper" was observed in 1845 when "wax molds phosphorized by means of a solution of phosphorus in carbon bisulphide were put into a solution of copper sulfate to receive an electrodeposit of copper."[28] This is of interest since many of the brightening additives which have been found effective in recent years have been active sulfur-containing organic compounds related in some ways to carbon disulfide (CS_2).

A variety of additives which have been investigated are listed in Table II. As in bright nickel plating, many of the proposed additive combinations depend on the cooperative and synergistic effects of a plurality of materials for optimum results. For example in bright plating formulations involving the use of active sulfur-containing compounds having such

TABLE II

ADDITIVES THAT HAVE BEEN INVESTIGATED FOR ACID COPPER PLATING

Patent Reference	Date of Issue	Investigator or Company	Additives
U.S. 2,391,289	12-18-45	Beaver	subst. thiourea + wetting agent + dextrin
U.S. 2,424,887	7-29-47	Henricks	reaction product of C_6H_6 + a sulfurizing agent
U.S. 2,462,870	3-1-49	Keller	thiourea + molasses
U.S. 2,475,974	7-12-49	Max	triethanolamine
U.S. 2,482,354	9-20-49	Max	tri-isopropanolamine
U.S. 2,489,538	11-29-49	Phillips et al	a cyanamide or dicyanamide
U.S. 2,563,360	8-7-51	Phillips et al	a thiourea + wetting agent
U.S. 2,602,774	7-8-52	Beaver	a thiourea + chloride
U.S. 2,663,684	12-22-53	Pierce	mercaptobenzothiazoles
U.S. 2,696,467	12-7-54	Overcash et al	thiourea + lignosulfonates
U.S. 2,700,019	1-18-55	Jernstedt	a thiohydantoin + organic carboxylate + P.R.
U.S. 2,700,020	1-18-55	Pierce	mercaptobenzimidazoles
U.S. 2,707,166	4-26-55	Brown et al	safranine dyes
U.S. 2,707,167	4-26-55	Hoover	safranine dyes
U.S. 2,733,198	1-31-56	Nobel et al	amino thiazole or aminothiazoline + aldehyde condensation products
U.S. 2,738,318	3-13-56	Fellows et al	safranine dyes + thioureas
U.S. 2,742,412	4-17-56	Cransberg et al	a thiourea + glycerol, glycol, or glycol ethers
U.S. 2,742,413	4-17-56	Cransberg et al	a thiourea + urotropine, pyridine or morpholine
U.S. 2,758,076	8-7-56	Passal	2 mercaptobenzimidazoles + thioureas
U.S. 2,762,762	9-11-56	Donahue	chloride control in electroforming
U.S. 2,798,040	7-2-57	Pye	acrylamide polymers
U.S. 2,799,634	7-16-57	Woehrle	a subst. thiohydantoin + a dithiocarbamate + dextrose
U.S. 2,805,193	9-3-57	Beaver	thiazine dyes
U.S. 2,805,194	9-3-57	Beaver et al	triphenylmethane dyes
U.S. 2,830,014	4-8-58	Gundel	organic sulfonic acids
U.S. 2,837,472	6-3-58	Gundel	organic sulfonic acids
U.S. 2,840,518	6-24-58	Condon et al	protein autolysate or enzymes + a thiourea
U.S. 2,842,488	7-8-58	Strauss	tertiary amines + sulfonic acids
U.S. 2,853,443	9-23-58	Harrover	alkylolamine + a thiohydantoin condensation product
U.S. 2,871,173	1-27-59	Castellano	o+p substituted meta amino benzene sulfonates
DBP 837,029	—	Gen. Mtrs. Corp.	substituted thioureas, thiocarbazides, thioamides
DBP 863,159	—	Dehydag	organic disulfimides
DBP 888,493	—	Dehydag	esters of sulfthio or trithio carbonic acid
DBP 924,489	—	Deutche Gold und Silber	condensation products of acrolein etc. and nitrogen compounds + polyglycolesters + alkali xanthates
DBP 932,709	—	Dr. W. Kampschulte	acetylenic alcohols + thiophenols
DBP 933,843	—	Dr. Hesse + Cie	polyvinylamines or polyvinylpyrrolidone
DBP 940,860	—	N. V. Metallic Inc.	thiourea + nitrogen heterocyclics
DBP 962,129	—	N. V. Metallic Inc.	thioureas + polyhydroxy alcohols
DAS 1,000,204	—	Dehydag	substituted nitrogen heterocyclics
DAS 1,004,009	—	Dehydag	substituted aromatic sulfonates
DAS 1,007,592	—	Dehydag	substituted thioureas or dithiocarbamates
DAS 1,011,242	—	Dehydag	organic sulfonates + polyacrylic or polymethacrylic acids
Aust. 172,066	—	Pfanhauser	colloids + thiourea + Ni or Co salts
French 952,619	—	Houdaille-Hershey	para tolyl sulfides, sulfoxides, disulfides or disulfoxides
French 1,097,166	—	Dehydag	substituted aromatic sulfonates
French 1,119,382	—	Dehydag	thioalkane sulfonic acids

reactive groups as the thiocarbonyl (=C=S), thiol (=CSH), sulfide (=S), sulfoxide (=S=O) and disulfide (—S—S—), there is a definite tendency toward the obtaining of non-uniform, striated deposits. Auxiliary additives of the protective colloid type (such as molasses and dextrin) and surface active agents (usually of non-ionic or anionic nature) are of value in counteracting this tendency, resulting in commercially acceptable deposits.

An increasing interest has occurred within recent years in the leveling characteristics of copper and other electrodeposits. This is of special importance when copper is plated on ferrous basis metals, to be followed by polishing and buffing to hide or fill in basis metal imperfections. Recent claims have been made for better leveling deposits from the sulfuric acid system.[29] It should be kept in mind, however, that the effect of additives on leveling, hardness, buffability, ductility and other deposit characteristics may vary widely depending on the stability of the additives, their rates of decomposition, introduction of extraneous metallic and organic impurities and other factors which sometimes are difficult to control. However with the proper choice of additives and scrupulous attention to optimum operating procedure, it is possible to attain leveling and other improvements with a fair degree of consistency.

The applications of sulfuric acid copper plating are many and constantly increasing, and the following list is a partial one of the many published uses.

1. Undercoating for nickel and chromium deposits
2. Roll plating[30]
3. Wire cladding[31, 32, 33]
4. Record matrices[34]
5. Heat treatment stop-off[35]
6. Heat conductivity for cooking utensils[36]
7. Lubricant for drawing operations
8. Electroforming[37, 38, 39, 40]
9. Barrel plating
10. Production of oxidized finishes
11. Electrotyping[41, 42]

B. Fluoborate Acid Copper

An increasing interest in the fluoborate bath has occurred in recent years, particularly since a copper fluoborate liquid concentrate became commercially available. Although the fluoborate bath is much more expensive than the sulfate bath, it offers sufficient advantages, such as higher plating speed, to justify the increased cost for certain specialized applications. A number of articles[43, 44, 45] have appeared giving solution compositions, operating conditions and suggested applications.

Table III gives recommended concentrations and operating conditions for the fluoborate bath.[5]

TABLE III

FLUOBORATE ACID COPPER CONCENTRATION LIMITS AND OPERATING CONDITIONS

Copper fluoborate	224–448 g/l (30–60 oz/gal)
Baumé at 80F	21 to 39°
*p*H (colorimetric)	0.3 to 1.4
Temperature	27 to 77C (80 to 170F)
Cathode current density	75 to 350 amp/ft² (or higher)
Agitation	Mechanical and air

The applications for the fluoborate system are generally the same as for the sulfate bath. Several recent publications disclose a very large scale use of the fluoborate bath for the plating of steel telephone drop wire.[46, 47, 48] In this application at the Point Breeze Works of Western Electric Co. (Baltimore, Md.) a bath is operated which is reported to have the following composition and plating conditions.[47]

Copper	20 oz/gal
Free(?) fluoboric acid	5 oz/gal
*p*H	below 1
Temperature	120 to 135F

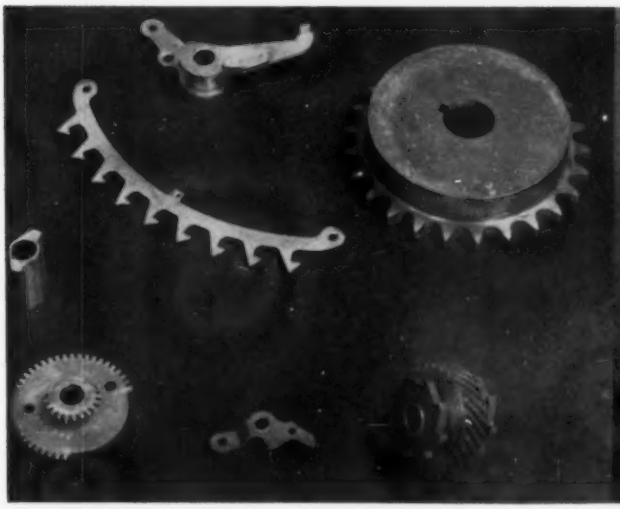

Fig. 2—Steel parts plated in pyrophosphate copper bath for selective hardening.

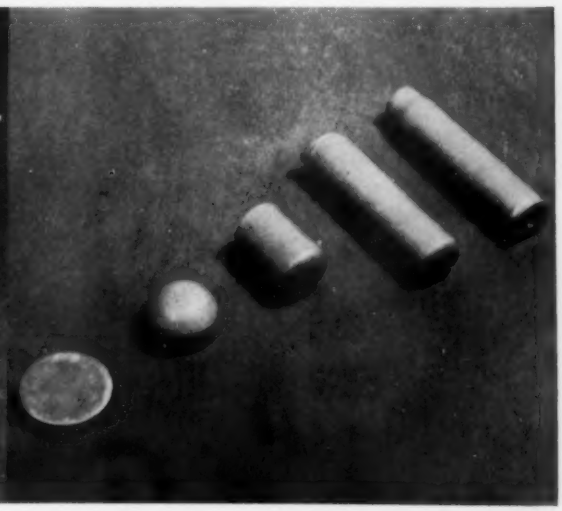

Fig. 3—Application of pyrophosphate copper as a deep drawing lubricant starting with a copper plated slug.

Fifty strands of steel wire of 0.033 in. diameter, traveling at the rate of 100 ft per minute are plated with 0.0025 inch of copper at a current density of 2000 amp/ft². After copper plating, the wire is coated with thin layers of lead and brass to provide good adhesion of rubber subsequently extruded around the outside. Careful engineering and selection of materials of construction are required because of the highly corrosive nature of the fluoborate copper electrolyte.

Additives for the fluoborate bath have not been as thoroughly investigated as for the sulfate bath. Such additives as thiourea and the protective colloids have been tried with no outstanding success reported.

C. Other Acid Copper Systems

Such systems as the alkane sulfonate,[5, 49] the formate[12] and the sulfonate[6] have been studied, but none of these seems to have achieved commercial importance. Tests made with the formate system for production of Ballard shells (0.006 in.) indicated possibilities for obtaining higher limiting current densities than for the sulfate bath. However, the deposits were not quite as ductile as desired and under the operating conditions used enough formic acid was evolved to constitute a health hazard without adequate ventilation.

Recently two systems have been proposed[50, 51] for use in the direct deposition of copper on aluminum and its alloys. One of these systems[50] comprises a bath within the *p*H range of 5 and 6.5 containing bivalent copper, pyrophosphate, oxalate and ammonia or tertiary amines. The other system[51] which has a *p*H below 4, contains bivalent copper, nitrate, citrate, sulfate and fluoride. Claims are made that these two baths dissolve the superficial oxide film on the aluminum, thus permitting intimate bonding of copper to the aluminum.

ALKALINE SYSTEMS

A. Pyrophosphate Complex System

Although it has been known for over a hundred years that the divalent copper-pyrophosphate complex anion is highly soluble and stable, and could be utilized for copper plating in alkaline media, only during the last twenty years has this type bath achieved commercial importance. A number of patents[52, 53] and review articles[3, 4, 54, 55, 56] have appeared disclosing bath formulations, operating conditions and applications.

A number of interesting articles have recently appeared on the chemistry of the pyrophosphate copper complexes.[57, 60, 61, 62, 63] Walters and Aaron[61] determined that within the *p*H range of 5 to 10 there is evidence of the presence of 1:2 and 1:1 complexes of metal to pyrophosphate, and that 2:1 and 4:1 complexes may exist in very dilute solutions. Within the *p*H range generally used for copper plating from the pyrophosphate complex, i.e. 7.0 to 9.5, the predominant complex seems to be the 1:2 complex Cu $(P_2O_7)_2^{-6}$. Interestingly, zinc also seems to form the 1:2 complex within this *p*H range, and this information is used to calculate the "free" pyrophosphate content when zinc is a bath impurity, i.e. the theoretical P_2O_7 to copper and zinc concentration by weight is assumed to be close to 5.5, and any excess P_2O_7 is assumed to be "free" pyrophosphate.

The latest recommended concentration limits, bath constituents and operating conditions are given in Table IV.

For plating on ferrous basis metals a cyanide or a pyrophosphate copper strike must be used before entering the above plating bath, to attain good adhesion. The latter strike contains 10 g/l of copper and 250 g/l P_2O_7 (ratio of P_2O_7/Cu = 25) plus 10 g/l of an organic complexing agent. This strike bath is generally operated at a *p*H of about 9.0, room temperature, 4 to 10 amp/ft².

TABLE IV

PYROPHOSPHATE ALKALINE COPPER CONCENTRATION LIMITS AND OPERATING CONDITIONS

Cu	22.5 to 30 g/g (3 to 4 oz/gal)
P_2O_7	170 to 210 g/l (23 to 28 oz/gal)
Wt ratio P_2O_7/Cu	7.0 to 8.5
NO_3^-	7.5 to 15 g/l (1 to 2 oz/gal)
NH_3	0.5 to 2 g/l (0.07 to 0.27 oz/gal)
*p*H	8.0 to 8.5
Temperature	38 to 60C (100 to 140F)
Cathode current density	10 to 70 amp/ft²
Agitation	Mechanical and air

For zinc and its alloys a preliminary cyanide copper strike is recommended before plating in the pyrophosphate bath.

In normal operation the P_2O_7 slowly hydrolyzes according to the following reaction:

$$P_2O_7^{-4} + H_2O = 2\,HPO_4^{-2}$$

Although the HPO_4^{-2} ion does not have any complexing action, it does aid anode corrosion and has a very definite buffering action as illustrated by the curve in Fig. 1:

The NO_3^- radical increases the limiting current density by acting as a hydrogen acceptor according to the following probable reaction:

$$NO_3^- + 10\,H^+ + 8\,e = NH_4^+ + 3\,H_2O$$

The cyanide which may be introduced from the cyanide copper strike acts as a detrimental impurity, and residual traces left on the surface being plated will often result in a tendency towards initially blotchy and non-uniform deposits. This tendency may be minimized by the use of a brief cathodic treatment in a solution of potassium pyrophosphate before entering the plating bath proper. Residual traces of CuCN formed by hydrolysis of the cupro-cyanide complex are believed to be either removed by the gassing action or reduced to metallic copper.

Certain organic impurities and cyanide are harmful but can normally be corrected by one of the following purification treatments:

1. Activated carbon treatment (2 to 5 lb/100 gal—130F—4 to 8 hr).
2. Potassium permanganate (0.1 to 0.2 g/l) followed by activated carbon treatment.
3. Hydrogen peroxide 30 per cent (½ to 2 pt/100 gal) followed by activated carbon treatment or addition of slight excess of sodium hypophosphite to destroy residual traces of H_2O_2 or complexes thereof.

Recently certain aromatic nitrogen heterocyclic thiols have been developed which in controlled concentrations may brighten the deposits, make the deposits more uniform in grain size, give a degree of leveling and improve buffability.[58, 59] For control, occasional analyses for copper, pyrophosphate and ammonia, and *p*H adjustment with

Fig. 4—Part plated with 3/16 in. thick copper in a pyrophosphate bath.

KOH or with $H_4P_2O_7$ or HNO_3, will suffice to keep the bath in good operating condition.

The P_2O_7 content of the bath can be determined by taking advantage of the following reaction:

$$H_2P_2O_7^{-2} + Zn^{++} = 2ZnP_2O_7 + 2H^+$$

The released hydrogen ion is a measure of the P_2O_7 content and is determined by titration with standard alkali.[55] Another convenient procedure is one by which $P_2O_7^{-4}$ and PO_4^{-3} are determined colorimetrically using the Molybdate-Vanadate color forming reagent. The total phosphorus content as PO_4 is determined after the acid hydrolysis of P_2O_7. From this total PO_4 content is subtracted the initial PO_4 content, also determined colorimetrically, and the difference is calculated as P_2O_7.

The pyrophosphate copper system has numerous applications such as the following:

1. Undercoating for nickel and chromium
2. Nitriding and carburizing stop-off
3. Roll plating
4. Printed circuit plating
5. Plating on plastics
6. Plating on aluminum
7. Electroforming
8. Lubricant for deep drawing operations

Of particular advantage for many applications is the approximate neutrality of the electrolyte. The deposits are especially dense and fine-grained.[60] Some parts plated with copper from a pyrophosphate bath as a stop-off for selective hardening are illustrated in Fig. 2. Fig. 3 shows the application of copper from this system as a lubricant for the deep drawings of steel shell casings. Fig. 4 illustrates a thick (3/16 in.) copper deposit from this system which is extraordinarily smooth and free of nodules. In Fig. 5 there is illustrated an electroformed part of 3/64 in. wall thickness, which has electroformed into it four 3/8 in. long posts by plating through four holes of approximately 0.094 in. inside diameter.

B. Monovalent Cyanide Complex System

The plating of copper from a cyanide complex dates back to the early years of the nineteenth century. In 1840 G. R. and H. Elkington obtained a patent[63a] on the plating of iron with copper, silver, or gold from a cyanide electrolyte, based on work of J. Wright. Wright is believed to have obtained the idea from a memoir of the famous chemist C. W. Scheele entitled "De Materia Tingente Coerulei Berolinensis" (1783) in which it was disclosed that copper has appreciable solubility in a cyanide containing solution.

Since monovalent copper in the presence of excess cyanide anion may form a number of possible cuprocyanide complex anions, a number of studies have been made to determine which species predominate as a function of (a) copper to cyanide ratio, (b) copper and cyanide concentrations, (c) excess cyanide concentration, (d) temperature, (e) *p*H, (f) ionic strength and other variables. In a recent article[64] the equilibrium conditions attained have been studied by infrared spectrophotometry. Table V summarizes the findings.

TABLE V

EQUILIBRIUM DATA FOR CUPROCYANIDE SYSTEM

Equilibrium	K in moles/liter (activities)	Free Energy of Formation F_f in k cal/mole
$\frac{[Cu^+]\,[CN^-]^2}{[Cu(CN)_2^-]}$	1×10^{-24}	$Cu(CN)_2^- = 58.5$
$\frac{[Cu^+]\,[CN^-]^3}{[Cu(CN)_3^{=}]}$	2.6×10^{-29}	$Cu(CN)_3^{=} = 91.8$
$\frac{[Cu^+]\,[CN^-]^4}{[Cu(CN)_4^{\equiv}]}$	5×10^{-31}	$Cu(CN)_4^{\equiv} = 129$

The following equilibrium constants (K) based on activities were calculated for a temperature of 29C:

$Cu(CN)_4^{\equiv} = Cu(CN)_3^{=} + CN^- \quad K_{4,3}^{\circ} = 0.026 \pm 0.002$

$Cu(CN)_3^{=} = Cu(CN)_2^- + CN^- \quad K_{3,2}^{\circ} = 4.2 \times 10^{-5} \pm 0.66 \times 10^{-5}$

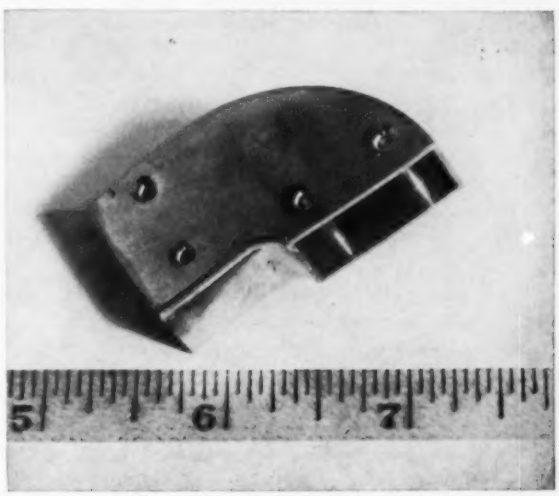

Fig. 5—Part electroformed in a pyrophosphate copper bath.

In another article[65] the stability constants of cuprocyanide complexes were studied by ultra-violet spectrophotometry in an investigation that involved the study of plating solutions. The change in the composition of cuprocyanide solutions with increasing concentrations of added cyanide ion was studied. The results reported for very dilute solutions agreed well with those from infrared measurements at much higher concentrations.[64, 66] The hydrolysis of cyanide to cyanate and ammonium formate were discussed by Deltombe and Pourbaix[67] and Marsh and Martin.[68] Simpson and Waind[65] discussed the preparation of pure cuprous cyanide for their ultra-violet spectrophotometric investigation.

The classical concept of the deposition of metal from a complex ion is that the ion dissociates to give a low concentration of simple metal cations which are then reduced to metal at the cathode. More recently[69, 70] the theory has been proposed that deposition proceeds directly from the complex anion and fairly substantiative evidence for this theory has been put forth.

Up to about 45 years ago cuprocyanide plating baths were generally prepared by dissolving a variety of divalent copper salts in solutions containing an excess of alkali metal cyanide.[1] This procedure, made necessary by the unavailability of cuprous cyanide, was somewhat wasteful, since some of the cyanide was oxidized according to the following reactions involving the use of cupric carbonate as the divalent copper salt.[71]

$$2\,CuCO_3 + 8\,NaCN = 2\,Na_2Cu(CN)_3 + 2\,Na_2CO_3 + (CN)_2$$

$$(CN)_2 + 2\,NaOH = NaCNO + NaCN + H_2O$$

According to the above reaction one-eighth of the original sodium cyanide is oxidized to cyanate. The intermediate cupric cyanide, a greenish yellow precipitate, decomposes into cyanogen and cuprous cyanide the latter of which dissolves in excess NaCN to form the cuprocyanide complex anion. In modern plating practice cuprous cyanide is generally used for bath preparation.

A number of reviews of cyanide copper plating have appeared from time to time giving bath compositions, operating conditions and applications.[1, 2, 20, 72, 73, 74, 75, 76]

In the early days of cyanide copper plating relatively thin deposits of copper were applied from baths having low metal contents and operated at low temperatures, as compared to present day practice. The baths tended to have low cathode current efficiency and the deposits were generally used as an undercoating for subsequent deposits from acid copper or nickel baths.

In the early nineteen thirties higher metal contents and operating temperatures were investigated by Pan[77] and others. Graham and Read[78] in 1937 and 1938 published the results of a comprehensive study of the cyanide copper plating system and the beneficial effects on anode corrosion and cathode deposits of additions of Rochelle Salt. Wagner and Beckwith also published in 1938 a study of effects of Rochelle Salt additions.[79]

The beneficial effects of Rochelle Salt and substitutes and improvements over this compound which are sold today as proprietary additives, are perhaps due to the complexing and solubilizing action these materials have on divalent copper. When anode current densities reach values where appreciable polarization sets in, a dark film of cupric oxide is formed, which tends to grow in thickness and insulate the anode. In the presence of chelating or complexing additives this film tends to dissolve and the resulting cupric complex anions

TABLE Va

CYANIDE COPPER STRIKE—CONCENTRATION LIMITS AND OPERATING CONDITIONS

CuCN	15 to 30 g/l	(2 to 4 oz/gal)
Free KCN or NaCN	7.5 to 15 g/l	(1 to 2 oz/gal)
KOH or NaOH	0 to 15 g/l	(0 to 2 oz/gal)
K_2CO_3 or Na_2CO_3	0 to 45 g/l	(0 to 6 oz/gal)
Rochelle Salt	15 to 45 g/l	(2 to 6 oz/gal)
or		
Rochelle Salt substitute	according to vendor's recommendations	
Temperature	20 to 60C	(70 to 140F)
Cathode current density	5 to 50 amp/ft²	
Cathode current efficiency	20 to 50 per cent	

TABLE Vb

ROCHELLE SALT TYPE BATH—CONCENTRATION LIMITS AND OPERATING CONDITIONS

CuCN	20 to 45 g/l	(2.5 to 6 oz/gal)
Free KCN or NaCN	3.8 to 15 g/l	(0.5 to 2 oz/gal)
K_2CO_3 or Na_2CO_3	15 to 60 g/l	(2 to 8 oz/gal)
Rochelle Salt	30 to 60 g/l	(4 to 8 oz/gal)
or		
Rochelle Salt substitute	according to vendors' recommendations	
*p*H colorimetric	12 to 13	
Temperature	50 to 70C	(120 to 160F)
Cathode current density	10 to 60 amp/ft²	
Cathode current efficiency	30 to 80 per cent	
Agitation	Mechanical and air	

TABLE Vc

HIGH SPEED TYPE BATH—CONCENTRATION LIMITS AND OPERATING CONDITIONS

CuCN	45 to 90 g/l	(6 to 12 oz/gal)
Free KCN or NaCN	5.5 to 18.5 g/l	(0.75 to 2.5 oz/gal)
KOH or NaOH	15 to 38 g/l	(2 to 5 oz/gal)
K_2CO_3 or Na_2CO_3	30 to 75 g/l	(4 to 10 oz/gal)
Rochelle Salt	0 to 45 g/l	(0 to 6 oz/gal)
or		
Rochelle Salt substitute	according to vendors' recommendations	
Temperature	60 to 82C	(140 to 180F)
Agitation	Mechanical or air	
Current cycles	Periodic interruption or reversal	
Anode current density	5 to 40 amp/ft²	
Cathode current density	5 to 100 amp/ft²	
Cathode current efficiency	90 to 100 per cent	

diffuse into the body of the solution where the copper is reduced to the monovalent state according to the following reaction:

$$2\ Cu^{++} + 8\ CN^{-}\ (excess) \longrightarrow 2\ Cu(CN)_3^{=} + (CN)_2$$
$$(CN)_2 + 2\ OH^{-} \longrightarrow CNO^{-} + CN^{-} + H_2O$$

Further important developments in cyanide copper plating were along the lines of improving the cathode efficiency and increasing limiting current densities by proper choice of bath concentrations and operating conditions. Higher copper contents and temperatures, and potassium salts or mixtures of potassium and sodium salts, were investigated together with effects of controlled free cyanide contents. An excellent review of the development of these higher speed baths was published by Oplinger in 1939.[80] In this investigation the beneficial effects of additions of the thiocyanate anion as a major bath constituent[81] and of cationic surface active agents[82] were discovered.

Most of the baths used in large scale cyanide copper plating today are based on the principles developed by Oplinger and his co-workers, and employing a variety of proprietary additives. Some of the more recent contributions and improvements to cyanide copper plating technology are listed in the following:

1. Use of periodic current reversal[83] and periodic current interruption.
2. Diaphragming[84, 85] and bagging of anodes.
3. Use of improved anodes such as OFHC.[86]
4. Development of proprietary additives as improvements over Rochelle Salt.
5. Development of materials for reducing hexavalent chromium such as sodium hydrosulfite,[87] stannous chloride and proprietary materials.
6. Improvement in manufacture of cyanides to minimize sulfide and other impurity contents.
7. Development of additives and operating conditions to improve leveling characteristics.
8. Development of additives to oxidize sulfide and similar impurities.[88]

Although bath and operating conditions may vary over wide limits depending on requirements, the concentration limits and operating conditions given in Tables Va, Vb and Vc for the copper strike, Rochelle salt and high speed type baths are representative of modern practice.

Many types of additives have been investigated for cyanide copper plating for such purposes as grain refining, increasing brightness, and leveling. The system seems to be responsive to additions of organic compounds having active sulfur groups and/or containing metalloids such as selenium or tellurium; organic amines or their reaction products with active sulfur containing compounds; inorganic compounds containing such metals as selenium, tellurium, lead, thallium, antimony, arsenic; and organic nitrogen and sulfur heterocyclic compounds.

One of the early additives used in cyanide copper plating for purposes of grain refinement and increasing deposit luster was "hypo" or sodium thiosulfate ($Na_2S_2O_3$). The beneficial effects of this additive may have been due to the formation of the thiocyanate anion[89, 90, 91] according to the following reaction:

$$CN^{-} + S_2O_3^{--} = CNS^{-} + SO_3^{--}$$

Nietzel and Desesa[89] outline a spectrophotometric method for determination of thiocyanate ion by measuring the adsorption of the ferric thiocyanate complex in nitric acid media. This procedure could be developed as a method for estimation of thiocyanate as a major bath ingredient or to study the fate of thiosulfate and other active sulfur containing additives.

A list of brightening and other purpose additives are given in Table VI which have been reported in the literature during the last thirty years.

The plating of copper from cyanide systems has widespread applications such as its use as an undercoating for nickel and chromium, as a heat treatment stop-off for selective hardening of ferrous parts, or as a strike and cleaning step prior to application of coatings from other baths. Copper deposits from cyanide baths are not generally suitable for deposition of relatively thick deposits for electroforming and similar purposes. A tendency exists for such deposits to develop excessive roughness and noduling, and to be high in hardness and difficult to machine. It is possible, however, to build up fairly thick, perfectly smooth deposits with proper choice of additives and with special precautions to avoid introduction into the bath of anode particles.

To counteract the tendency toward deposit roughness in the cyanide system strict attention must be given to adequate filtration, preferably with separation of anode and cathode compartments, by diaphragming or bagging. A good filter aid mixture recommended by a division of one of the large automotive companies is a mixture of equal parts by volume of Filterbestos and a cellulosic type filter aid.

For bagging of anodes, which seems to be a recent trend, cotton bags of regulated weave and porosity must be used to minimize a tendency toward anode polarization. When bags are used the anode current density should be kept below 10 ASF and Rochelle Salt or proprietary Rochelle Salt substitutes can be added to decrease anode polarization. One large automotive installation has found that the bags must be removed and cleaned every four weeks and 70 per cent of the bags replaced, to avoid serious anode polarization effects.

To increase plating speed, to give more uniform deposit luster and grain size, and to increase tolerance toward contaminants, periodic reversal and interruption of current are used extensively, particularly the latter. Air agitation is used in many installations, and wetting and anti-pitting agents are available which are low foaming in nature and which may also act as brighteners and increase tolerance toward contaminants.

A variety of wetting and anti-pitting agents have been used in the cyanide system such as cationic substituted betaines and quaternary ammonium derivatives. Recently there has been a trend toward use of non-ionics such as polyoxyethylene ethers, anionics such as the polymeric methylene-bis-naphthalene sulfonates, or anionic-cationic bi-functional materials. The different types of wetting agents have varying degrees of compatibility with impurities which may be introduced into the bath. Many of these incompatibilities may result in loss of deposit luster, serious deposit blotchiness and non-uniformity, striations, pitting, and other effects. The proper choice of wetting agents and anti-pitters must be made on the basis of careful study of possible contaminants.

Since cyanide copper deposits generally have low micro throwing power, they generally do not have much hiding

TABLE VI

ADDITIVES THAT HAVE BEEN INVESTIGATED FOR CYANIDE COPPER PLATING

Patent Reference	Date of Issue	Investigator or Company	Additives
U.S. 1,863,869	6-21-32	McCullough et al	tartrates and citrates
U.S. 2,065,082	12-22-36	Lewis	aluminum plus citrate
U.S. 2,129,264	9-6-38	Downing et al	quaternary ammonium compounds
U.S. 2,164,924	7-4-39	Hull	calcium to remove carbonate
U.S. 2,255,057	9-9-41	Holt	betaines as antipitting agents
U.S. 2,287,654	6-23-42	Wernlund	sulfocyanides + carbohydrates
APC 351,241	5-18-43	Weiner	inorganic selenium and tellurium compounds
U.S. 2,347,448	4-25-44	Wernlund	sulfocyanide
U.S. 2,471,918	5-31-49	Willson	acylthiophenes
U.S. 2,495,668	1-24-50	Willson	mercapto alcohols, glycols, carboxylic acid or alcohol sulfide
U.S. 2,541,700	2-13-51	Holt	quaternary ammonium compounds as anti-pitters
U.S. 2,582,233	1-15-52	Chester et al	sulfided polyamines
U.S. 2,609,330	9-2-52	Passal	rhodanine and derivatives
U.S. 2,612,469	9-30-52	Reisinger	reaction products of anthranilic acid + hydrogen sulfide + triethanolamine
U.S. 2,636,850	4-28-53	Jernstedt	zinc + thiocyanate + PR
U.S. 2,677,653	5-4-54	Chester et al	coke oven by-product
U.S. 2,677,654	5-4-54	Chester et al	dithiobiuret
U.S. 2,690,997	10-5-54	Jernstedt	lithium to give increased speed
U.S. 2,694,677	11-16-54	Ostrow	selenium (—2) + aldehyde polyamine condensation products
U.S. 2,732,336	1-24-56	Ostrow	selenium + lead or antimony + polyamines
U.S. 2,770,587	11-13-56	Ostrow	selenium (—2) compounds
U.S. 2,771,411	11-20-56	Chester et al	coke oven by-products
U.S. 2,771,412	11-20-56	Chester et al	coke oven by-products
U.S. 2,737,485	3-6-56	Overcash	selenium + zinc + quaternary amine + tartrate
U.S. 2,773,022	12-4-56	Turner	alkyl dithio carbamates of Cd, Co, Ni, Zn
U.S. 2,774,728	12-18-56	Wernlund	antimony + thiocyanate + methylene bis naphthalene sulfonates
U.S. 2,778,788	1-22-57	France	Mo, Pb, Sn, Cd + wetting agent mixture
U.S. 2,783,194	2-26-57	Nobel et al	iodates to oxidize sulfide
U.S. 2,785,117	3-12-57	Ceresa et al	lithium for improved speed
U.S. 2,787,590	4-2-57	Rinker	barium metallic cyanide for carbonate precipitation
U.S. 2,809,929	10-15-57	Ostrow	anode containing Ni, Co, Fe
U.S. 2,813,066	11-12-57	Ostrow	alkylpolyamines to complex metallic impurities
U.S. 2,814,590	11-26-57	Portzer	selenium chelates with amines
U.S. 2,825,684	3-4-58	Wernlund	inorganic selenium compounds + Cd, Bi or Ag.
U.S. 2,838,448	6-10-58	France	arsenic, zinc + amines
U.S. 2,841,542	7-1-58	Manquen	tellurium + salts of organic acids
U.S. 2,848,394	8-19-58	Foulke et al	titanium coordination compounds
U.S. 2,854,389	9-30-58	Boelter et al	copper selenide—methylene bis naphthalene sulfonate
U.S. 2,858,257	10-28-58	Ceresa et al	removal of carbonate with calcium
U.S. 2,859,159	11-4-58	Wernlund	antimony + Zn, As, Co, Fe or Cd
U.S. 2,861,928	11-25-58	Ceresa et al	removal of carbonate with calcium
U.S. 2,861,929	11-25-58	Martin et al	selenate or selenites + methylene bis maphthalene sulfonates
U.S. 2,862,861	12-2-58	Moy	thio substituted 6 member nitrogen heterocyclics
U.S. 2,873,234	2-10-59	Passal	selenium bis dithiocarbamates
U.S. 2,873,235	2-10-59	Passal	tellurium bis dithiocarbamates
Aust. 187,767	—	Langbein-Pfanhauser	betanaphtol + metanitrobenzoic acid + saccharin
Aust. 195,204	—	Langbein-Pfanhauser	thallium compounds
Can. 401,287	—	Hull	methoxy phenyl aldehydes + Al, Ti or other metals
Can. 401,288	—	Hull	oxyheterocyclic compounds + Al, Ti or other metals
Can. 562,949	—	Ceresa et al	plating from lithium cupro cyanide
DBP 874,100	—	Gunter Muschenig	acetylene derivatives
DBP 879,048	—	Deutche Gold und Silber	selenium and/or tellurium compounds + organic acids
DBP 895,686	—	Dr. W. Kampschulte	alkali formaldehyde sulfoxylate + unsaturated alcohols
DBP 924,489	—	Deutche Gold und Silber	condensation products of acrolein etc. + nitrogen compounds + polyglycol esters + alkali xanthates
DBP 924,490	—	Schering AG	oxyethyl ethers + acetylenic alcohols
DBP 933,843	—	Dr. Hesse + Cie	polyvinylamine or polyvinylpyrrolidone
French 1,055,127	—	Zinc et Alliages	furfural + coumarin + piperazine
French 1,097,166	—	Dehydag	organic aliphatic sulfonates

[20]Nobel, F. I., and B. D. Ostrow, Proceedings AES, 130-38 (1954). U.S. 2,733,198 (Feb. 7, 1954).

[21]Benner, H. L., and C. J. Wernlund, "The High Efficiency Cy-

power or ability to cover basis metal defects. It has been observed in plant practice that modifications of the copper strike, either by suitable additions or by proper choice of operating variables and composition, will result in very dull, reddish deposits which improve the hiding power of subsequent relatively thick copper deposits.

Several of the newer proprietary copper plating processes have claimed substantial improvements in leveling characteristics which should aid in bridging basis metal defects.

FUTURE OF COPPER PLATING

Copper plating has become an important integral part of the electrochemical industry and its future should be one of continued improvement and expanding application. Some general improvements which may be considered for the future are the following:

1. Development of more stable and easily controllable additives.
2. Development of more convenient and economical waste disposal treatments.
3. Development of improved purification treatments to remove contaminants (chemical precipitation, selective ion exchange, etc.).
4. Development of alkaline type baths with better and more consistent leveling.

Because of the nature of the electrolyte the cyanide copper system, particularly the modern bright and semi-bright formulations, may at times give operational difficulties which are not too thoroughly understood and which at times are not easy to correct. Most of these difficulties are due to traces or higher concentrations of extraneous impurities, or to additive decomposition products. In contrast to nickel plating, where a variety of chemical precipitation, oxidation, reduction, and electrochemical purification treatments are available, the cyanide system is lacking in ease of handling of contamination problems. One of the most difficult and persistent problems in the modern high speed baths is low current density "step-plate," which manifests itself usually in low current density areas as off-color deposits with a pronounced tendency toward formation of striations or deposits which in adjacent areas build up in thickness at unequal rates. This "step-plate" phenomenon, which may involve selective or preferential adsorption of organic or inorganic matter, is not too well understood and warrants further study and investigation.

It has also been observed with the high speed cyanide systems that improper balance of bath constituents and certain additives and their decomposition products at times will result in dome-shaped, friable, dark reddish-brown, scattered nodules which do not seem to be connected with shelf-roughness or anode particle effects. These nodular growths, which fortunately are only visible after plating of unusual deposit thicknesses, may in thinner deposits account for general over-all slight roughness which at times is troublesome, and certainly is not conducive to a finished plated article having good corrosion resistance.

Many new applications for copper plating are possible. For example, with the present popularity of "duplex" coatings for imparting improved corrosion resistance, it is not inconceivable that a combination of copper deposits from different types of bath, and having different metallurgical structure, chemical purity, and reactivity, might substantially improve corrosion resistance. Another application of copper plating which has been recently considered is its use as a stop-off for the "chemical milling" of aluminum. Since copper also acts as a barrier for hydrogen penetration, it can act in thin films to prevent or minimize hydrogen embrittlement of a basis metal, i.e. embrittlement of nickel deposits or ferrous basis metals by chromium plating.

For the benefit of the electroplating industry it is hoped that the next fifty years will be as productive in copper plating improvement and application as the last.

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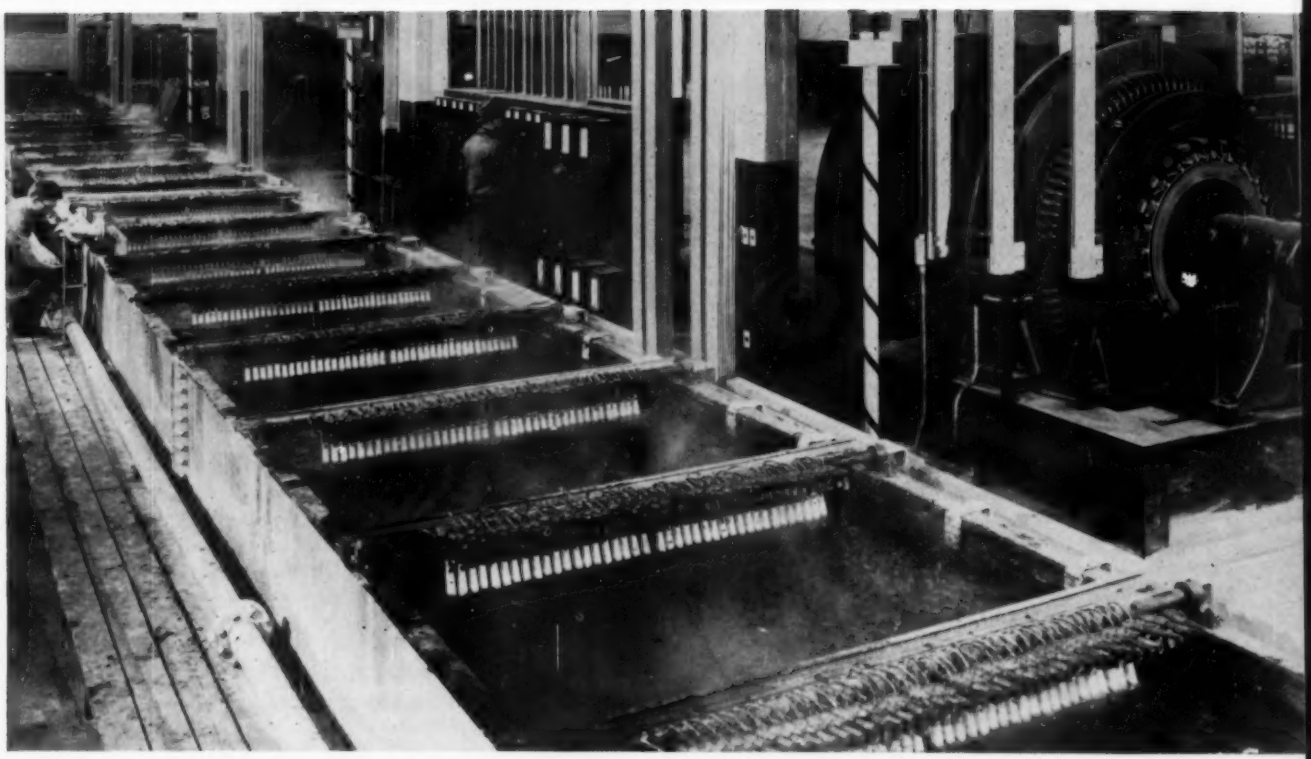

Electrogalvanizing cell showing multiple units of electrodes.

ZINC IN THE WORLD OF ELECTROPLATING

by E. W. HORVICK*

IN THE 19TH CENTURY, as iron and steel came into more extensive use, their susceptibility to rusting was quickly realized to be a serious problem. The need for suitable protective coatings was early recognized and zinc was employed for this purpose over a century ago.

Zinc coatings applied by various methods have been regarded as the most practical method for retarding corrosion of iron and steel throughout the years. While some historians state that the electroplating of iron and steel with zinc for protection against corrosion was first proposed in 1840, as indicated by the following classical reference, zinc was electrically deposited prior to this date.

"In 1829 Dr. John W. Revere of New York, brought before the Lyceum of Natural History of that city, samples of zinc-coated spikes and small plates attached to wood, the whole having been exposed to the action of sea air and water since 1827. Revere was convinced that the coating of zinc formed an excellent protection for iron articles. The mention of electrochemical terms in Revere's work indicates that the coating was accomplished by what is known as the electrogalvanizing process."

It was in the year 1800 that the power of the electric current to decompose water was first observed, the discovery being made by Nicholson and Carlisle. It is interesting to note from the description of this first electrochemical experiment that the voltaic battery furnishing the current was made up of plates of zinc and silver.

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Shortly after, Sir Humphry Davy became engaged in electrochemical research. His work in this field was well along by the end of 1807 and included indications that one metal could be deposited upon another. The name of the first man to deposit zinc on steel electrically is lost in history. However, Dr. Revere's reference to 1827 established it as having been done prior to that date.

The first patents relating to electrogalvanizing were issued in England in 1852. English patent 951 issued to Wall in 1852 describes a solution for electrically depositing zinc upon iron and states that the work of deposition is to be carried out by means of voltaic cells. Other early English patents namely Person, No. 951 of 1854; Puls, No. 1276 of 1855; Brown, No. 1175 of 1857, all show that the problem of depositing zinc upon iron by electrochemical means received considerable study.

An alkaline zinc cyanide plating bath was patented as early as 1855, although baths of this type did not attain commercial importance until 1916. The first American zinc plating patent was granted in 1862, but extensive use of the electrolytic process of galvanizing was a physical impossibility in these early days prior to the advent of the electric dynamo because of the limited electrical power available from batteries. Then, a battery of six Daniell cells in series parallel was only capable of delivering 120 ampere-hours in ten hours. This was only enough power to deposit 4.8 ounces of zinc.† The

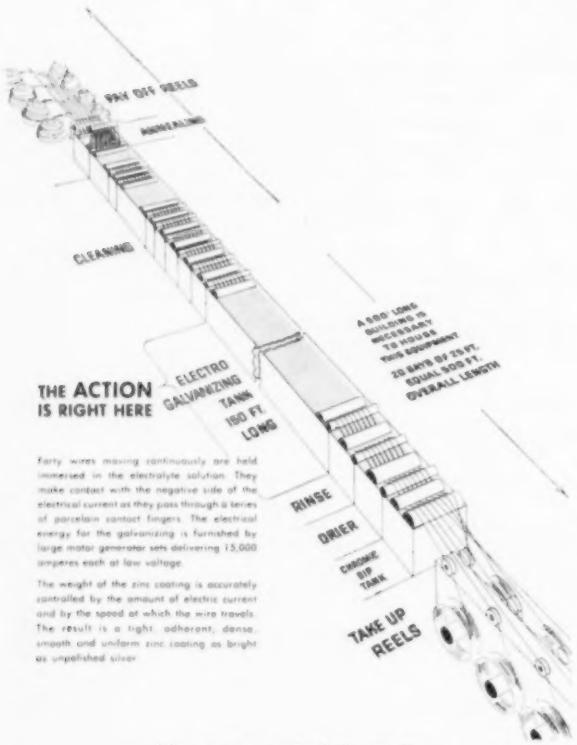
† Now, with modern electrolytic DC power sources, 12,000 amperes at 18 volts could deliver 120,000 ampere hours in ten hours, and would deposit 4800 ounces of zinc in the same time on one fully automatic machine.

weak current used for the purpose of depositing or plating came exclusively from batteries until the practical work on copper refining of Elkington in 1867.

The first practical dynamo appeared about 1880, but some 20 years of development passed before they became reliable. The plating of most metals upon another by electrochemical means requires the use of an electrogenerator or dynamo having low voltage combined with large capacity in amperes of current delivered. It required much research to develop this particular type of dynamo and generate a suitable level of efficiency. The possibilities of the electrodeposition of zinc was therefore unappreciated until that time. However, after the invention of the dynamo and while its improvement was taking place, a revival of electrogalvanizing ensued. This is manifested in the patents issued to Elmore in 1881, Classen in 1882, Philip in 1890, and Cowper-Coles in 1893. Other patents for electrodeposition of zinc, mainly for solutions, were subsequently issued in England, Germany, France and the USA. From 1880 to 1903, the total of these from the above countries was 49. However, the early zinc electroplating solutions permitted the use of current densities of only 5 to 20 amperes per square foot of surface being coated, so that zinc was deposited at too slow a rate for general application. Not only was the plating slow, but the control was so uncertain that the work was frequently unsatisfactory. In effect, the zinc coatings generally produced then were dull, non-uniform, unattractive and limited in corrosion resistance because they were deposited from inefficient baths or inadequately cleaned work.

THE DEVELOPMENT OF THE INDUSTRY

Early in the 20th Century, the zinc electroplating industry began to develop and grow from its humble inheritance of the previous century. The development stems from the creation and invention of various electroplating processes. A brief discussion of these processes will show how their development contributed to the advancement of the zinc electrocoating industry.


PAY OFF REELS
ANNEALING
CLEANING
THE ACTION IS RIGHT HERE
ELECTRO GALVANIZING TANK 150 FT. LONG
A 500' LONG BUILDING IS NECESSARY TO HOUSE THIS EQUIPMENT
20 BATHS OF 25 FT. EQUAL 500 FT. OVERALL LENGTH
RINSE
DRIER
CHROME DIP TANK
TAKE UP REELS
Forty wires moving continuously are held immersed in the electrolyte solution. They make contact with the negative side of the electrical current as they pass through a series of porcelain contact fingers. The electrical energy for the galvanizing is furnished by large motor generator sets delivering 15,000 amperes each at low voltage.
The weight of the zinc coating is accurately controlled by the amount of electric current and by the speed at which the wire travels. The result is a tight, adherent, dense, smooth and uniform zinc coating as bright as unpolished silver.

How zinc is applied electrically.

The Meaker Process

Confronted with the necessity of rust-proofing certain steel products which existing methods of electrogalvanizing could not handle in 1905, Guy L. Meaker developed a new process and solution which soon gained recognition as the first successful electrogalvanizing.

This process combined an advanced, high-speed electrolyte of the sulfate type with scrupulous precleaning of the steel, without which the adherence of the zinc is faulty and its corrosion resistance is impaired. For many years careless pickling had been regarded as adequate before electroplating, since it was thought that the remaining dirt and scale were covered by the plate anyway. However, because this did not permit good plating, stringent cleaning was required in the Meaker process.

Tainton and Bethanizing Process

The Tainton or Bethanizing process, developed in 1932–1933, is a special application of acid sulfate zinc plating, using insoluble silver lead anodes. In this process the raw material is roasted zinc concentrate containing about 65 per cent metallic zinc. The zinc content of the plating bath is derived from roasted zinc ore concentrates which are dissolved in sulfuric acid; the solution is then highly purified. The zinc does not appear in metallic form until it is deposited from the electrolyte onto the carefully cleaned steel wire.

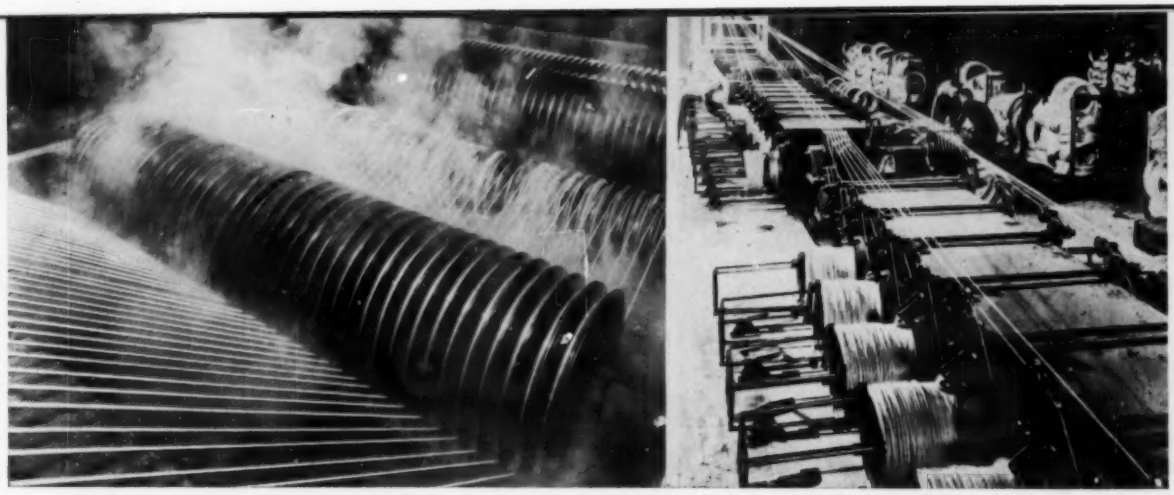
The process is carried out in long bath cells through which the wire passes. The current employed is of very high amperage. Since the plating solution is highly conductive and highly agitated by the fast moving wire, current densities from 1000–2000 amp/sq ft can be used. The current passes to the wire from the insoluble anodes and is taken off by sliding cathode contacts at close intervals.

The coating obtained is never less than 99.99 per cent pure zinc. It is uniformly and continuously built up on the steel base as the wire passes through the solution. The weight of the coating which can be two, three or more times heavier than other zinc coatings and still not be affected by the most severe fabricating operations, is determined by the speed of the wire. As this speed can be accurately regulated at all times, the weight of the coating can be controlled with precision. In order to improve appearance, the plating can then be compacted and burnished, or drawn through tungsten carbide dies for smoothing and brightening the coatings.

The Herman Process

The first electrogalvanizing process used on a large commercial basis was that developed at the Langbein-Pfanhauser Works in Germany. This very important development in the history of the zinc plating industry, known as the Herman Process, uses a nearly neutral sulfate bath as an electrolyte and plates with zinc anodes at moderate current densities—from 50 to 100 amp/sq ft. The Herman Process was apparently the first to develop the necessary wire handling methods combined with a more advanced wire cleaning method, making possible the production of reasonably heavy coatings in a commercial scale operation.

With certain variations in electrolyte composition and methods of wire cleaning, essentially similar processes em-



Photographs Courtesy Republic Steel Co.

To clean thoroughly before galvanizing, wire is immersed in hot acid and then water rinsed.

Take-up reels at the end of the electrogalvanizing tank at Republic's Chicago wire mill.

ploying soluble zinc anodes have been used in electroplating plants set up in the United States.

The Marino Process

The Marino electrogalvanizing process is a development in the zinc plating field which is considered similar in procedure to the Meaker Process.

The Hubbell and Weisberg Process

The Hubbell and Weisberg process was developed around 1940. It was introduced as a new method of electroplating zinc on steel by utilizing waste materials instead of new metal for coating. The advantage of the process lies in its ability to use cheap sources of zinc instead of zinc anodes. The zinc is dissolved from galvanizer's skimmings, brass foundry fume, organic reduction residues or by a solution of ammonium chloride and ammonia. Insoluble graphite anodes are used in the plating tank, but iron or stainless steel anodes may be used.

The zinc plating takes place from this alkaline electrolyte which is first purified. Plating reduces the zinc content of the electrolyte which is then returned to the leaching plant where the zinc removed by plating is replaced. The plating tank is specially designed to take advantage of the fact that the anodes seldom have to be changed, and to provide covers that prevent escape of ammonia fumes, and at the same time permit easy rethreading of wires and strip.

High current densities are employed in the Hubbell and Weisberg process, an aspect which together with the high conductivity of the solution, and the design of overall equipment, makes the process highly economical in use of electrical power.

A significant advantage achieved in the process is that savings increase as the amount of zinc used increases, considering that a special plant has to be provided to put zinc in the skimmings or other products into solution; also, the operating costs of this plant must be added to the purchase price of the zinc, in skimmings and other waste materials, to obtain the actual cost of zinc used in the plating tank.

Rapid Zinc Process

In the early 1940s' the Harrison-Van Winkle Company developed a new type of acid bath and method of application known as the "Rapid Zinc Process." The electrolyte is simple in composition—consisting of zinc chloride and zinc acetate without addition agents. Coatings are deposited at current densities of 40 to 1000 amp/sq ft.

When zinc-aluminum anodes are used, as explained in another section, no chemical attack is incurred when the electrolyte bath is idle. This, in conjunction with practically 100 per cent anode and cathode efficiencies and the inherent stability of the chemical constituents of the bath, results in almost constant solution *p*H. The rate of solution flow depends upon the particular application. A simple method of analysis for bath control is also included in the process.

The Corronizing Process

Corronizing is a process in which a composite electroplated coating is used. This is comprised of a layer of nickel plated on the basis metal, followed by a layer of zinc (or tin). The process was developed and introduced in the early 1940's. The dual coating is heated for a period up to six hours at a range of temperatures in excess of 500F, depending upon the thickness of the basis metal and the conditions which it must meet. The operational sequence—similar to conventional plating procedure, consists of cathodic cleaning, pickling for scale removal, anodic pickling, nickel plating, zinc plating from an acid bath, and then heat treatment.

Plating Solutions

The various zinc electrocoating processes and applications that have been developed over the past half century have been and still are characterized by the compositions of the plating baths. These are of two general types: one utilizes an acid electrolyte, and the other an alkaline electrolyte. The former are known as sulfate, sulfate-chloride, chloride, chloride-acetate, and fluoborate baths, depending upon their chief constituents. The alkaline electrolytes are mostly cyanide baths, although zincate and pyrophosphate baths also have their advocates.

The choice between the type used is based upon a number of factors; for instance, in considering which bath to use, the higher plating rate and low operating costs of acid baths have to be balanced against the superior throwing power of the alkaline cyanide baths. Thus, the acid baths, although having poor throwing power, are used largely for plating strip and wire because of their high plating rate and lower operating costs. Alkaline cyanide baths, with their better throwing power, are used in plating objects of irregular shape.

Acid Baths

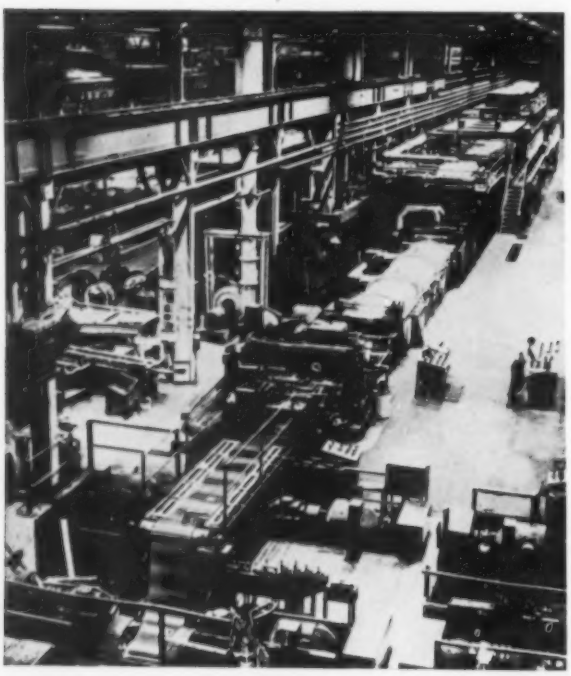
Of the acid baths, the sulfate solution is the most widely used. Reasonably priced zinc sulfate is the principal salt in this bath and because it is highly soluble in water, solution can be highly concentrated, with the advantage that the general ratio of zinc to other type ions makes possible increased rate of zinc deposition. Because of high anode efficiency and the tendency of anodes to corrode, additions of sulfuric acid must be made periodically to maintain acidity. Also, sodium acetate or aluminum chloride are added to the bath because their buffering action helps regulate solution *p*H.

The sulfate bath is the most commonly used electrolyte for zinc electrodeposition. As mentioned earlier, it is used extensively for coating wire and strip. Deposits from this bath are whiter but coarser-grained than those deposited from cyanide baths.

Chloride baths made from solutions of zinc, sodium and aluminum chlorides yield very good deposits. The higher conductivities of these baths allow them to be run at high current densities, without requiring agitation or other precautions to prevent overheating the electrolytes.

Chloride acetate solution is the electrolyte used for the "Rapid Zinc Process." Only zinc chloride and zinc acetate without additive agents are used in this solution. The bath may be operated with zinc-aluminum alloy anodes so that no chemical attack of the anodes takes place when the bath is not in use.

Fluoborate baths provide a comparatively new method of zinc electroplating. They can be operated at very high current densities without impairing the deposits. It is claimed that the fluoborate electrolyte gives good results with cast and malleable iron, where plating in a cyanide bath is a problem.



Electrogalvanizing or electroplating zinc on steel has made considerable progress in recent years and is becoming an important factor in the protective coating field.

Alkaline Baths

The alkaline baths are generally used for batch zinc electroplating, and are capable of providing a variety of deposits. While the cyanide baths have formed the basis for most of the alkaline electrolytes, comparatively recently baths employing ammonium salts have been developed. The relative advantages of alkaline baths such as superior throwing power and disadvantages with respect to plating rates and operating costs have already been discussed.

Alkaline cyanide baths are made up largely of zinc cyanide in solutions of sodium cyanide and sodium hydroxide. They are found to be the most easily controlled of all the zinc plating baths. The cyanide electrolytes are employed with comparatively low current densities and soluble anodes. They yield fine grained deposits which, from the plain baths, are quite dull—with small additions of mercury, however, a white matte can be produced.

An important development in the electroplating of zinc was the introduction of bright zinc coatings directly from the plating bath. However, these coatings are frequently given a bright dip to further enhance their decorative qualities. Bright zinc plating is obtained from cyanide baths free from heavy metallic impurities or by the use of special agents in the bath which act in brightening the deposit and improving the throwing power at low current densities. The brightening additives are composed of organic compounds such as gelatin, glucose, dextrin, and condensation products of phenols and aldehydes. They are normally used with soluble salts of chromium, molybdenum, cobalt, nickel and germanium. Superior corrosion resistance is claimed for these bright deposits.

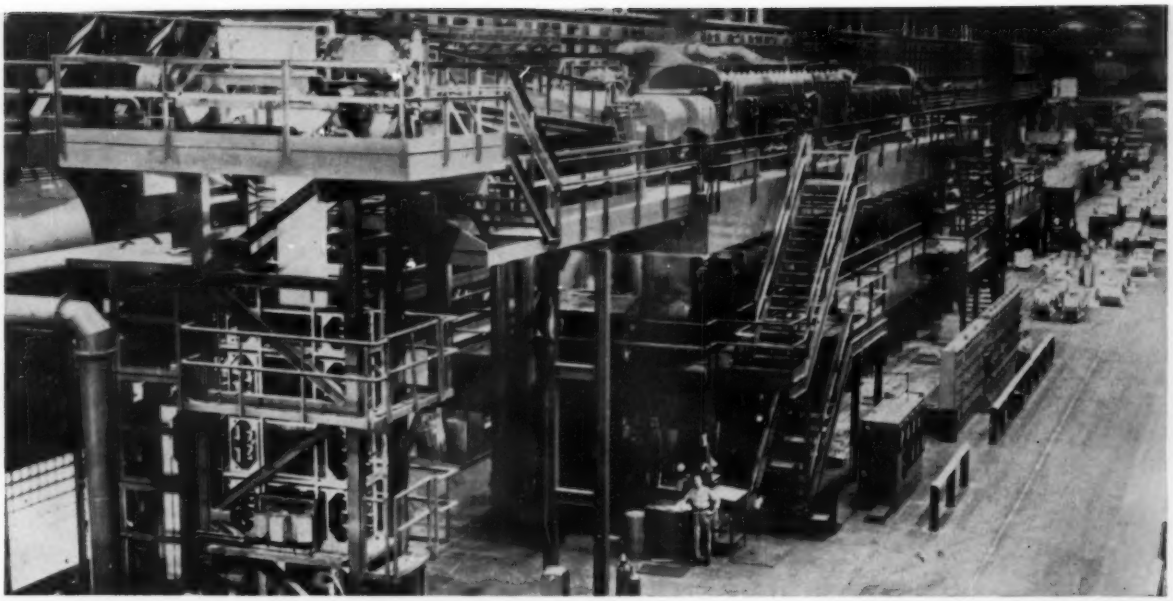
Pyrophosphate and sodium zincate baths which have been developed are described in the literature. The zincate bath contains additions of various chemicals including sodium cyanide which acts to refine the grain size of the coating.

ANODES

Anodes used for electrodeposition of zinc are of two types—soluble and insoluble. The soluble anodes are obviously of zinc to provide the metal to be plated. With insoluble anodes, the zinc is furnished to the electrolyte by leaching material containing zinc oxide, as explained in the section on the Tainton or Bethanizing process.

In the electrodeposition of zinc with soluble anodes, the zinc ions in the electrolyte are maintained during operations by electrolytic dissolution of the zinc of which the anodes are comprised. The plating or electrogalvanizing solution automatically maintains itself by dissolving zinc from the anodes in the exact quantities being plated out on the steel that is being coated. Over the years there has been, however, considerable change in opinion as to what the anode composition should be.

In the early days the composition of the zinc used for anodes differed widely, containing impurities of varied types and amounts. Neither zinc of high purity, nor means of controlling exact composition were available, and as a result, film quality was often inferior. In more recent years, soluble zinc anodes have been commonly made from cast or wrought metal of such grades as Prime Western (98.5 per cent), Intermediate (99.5–99.8), and higher purity of the order of 99.95–99.98 per cent zinc. With these, continuous filtration has been customary in large continuous installations but not in still tank operation, although suspended material must be removed periodically to prevent pitting, roughness, and



Photograph Courtesy Weirton Steel Co.

400-foot-long lines have revolutionized the production of zinc-coated sheets and strip.

poor deposits. Sludge represents loss of zinc metal and must be removed to permit high quality of work. Certain metallic impurities also may go into solution, and in codeposition with zinc have adverse effect on corrosion resistance and appearance of the deposit.

While over the years all grades of zinc have been used for anodes, it has been found that best results are undoubtedly obtained with Special High grade (99.99 per cent pure) zinc. The advantages of pure zinc for anodes have been realized since the beginning of the zinc electroplating industry but could not be exploited until modern methods rendered the manufacture of such high purity zinc a commercial reality. Now, with 99.99 per cent purity zinc, the formation of sludge from local action of zinc with metallic contaminants is minimized. Sludge not only represents loss of zinc but also detracts from efficiency in that it must be removed from the bath to permit consistently smooth deposition.

With Special High grade zinc anodes, in addition to this advantage, higher plating efficiency is achieved, and it is possible with various proprietary solutions (to be discussed in a later section) to secure extremely bright zinc coatings. In general, with these anodes higher quality if obtained irrespective of the type of zinc plating produced.

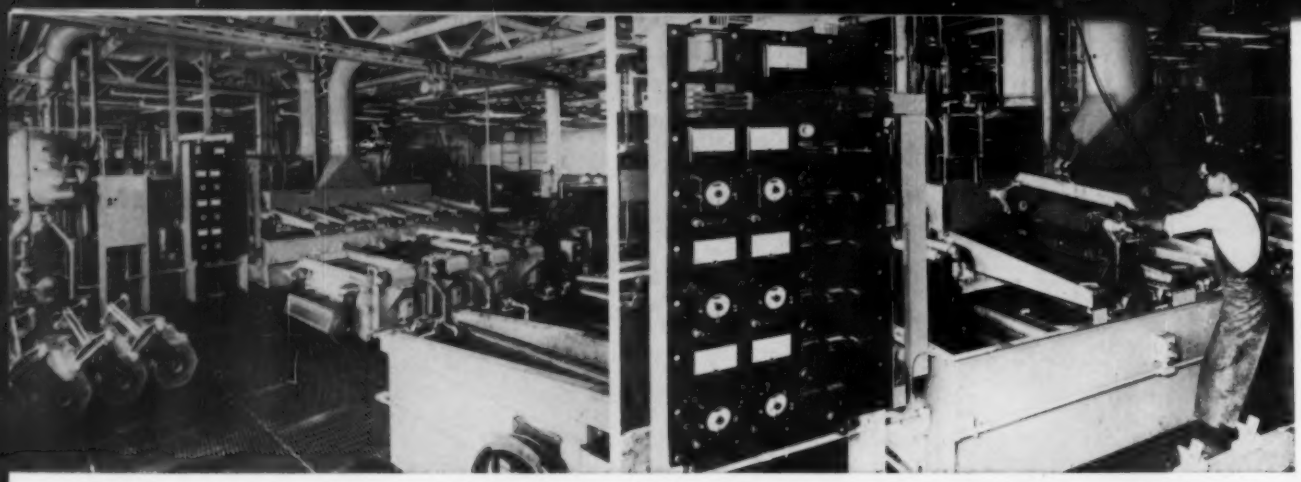
All zinc anodes, but least of all high purity zinc, tend to be dissolved by direct chemical attack when the plating bath is not in operation, resulting in loss of the metal by corrosion, and saturation of the electrolyte to such a high degree that it cannot be operated efficiently. With Special High grade zinc, because of the high anode efficiency, the electrolyte gradually tends to become supersaturated with zinc. As a result of demands from industry for improvements, research was carried out to ascertain the effects of alloying anodes with certain metals which are not harmful to the bath. To minimize anode dissipation during idle time, and promote uniform corrosion during operation, anodes alloyed with aluminum and mercury for cyanide solutions or magnesium and calcium for acid electrolytes were introduced. These additions were found to eliminate excessive differences between anode and cathode current efficiency. Excessive anode dissolution has also been minimized by use of auxiliary sheet steel, nickel plated sheet steel, or sheet nickel anodes along with the zinc anodes. Auxiliary anodes have likewise been found to be helpful when plating steel with zinc, if recessed parts are being treated, in that they ensure a uniform deposit over an irregularly shaped surface.

ELECTROGALVANIZING OF STRIP STEEL

Developments in the steel industry at the end of the 1920's which provided inexpensive metal with deep drawing properties, set the stage for large scale electrogalvanizing of strip steel. After the introduction of the continuous hot mill in 1927 came the development of means for cold reduction of the bands in 1929. These two innovations were the basis for the modern high speed continuous hot and cold tandem mills which convert a 17,000-pound slab to a ribbon of steel of uniform desired width and thickness at a fabulous speed—in excess of a mile a minute. Thus, large tonnages of wide strip steel were made available for different processes including electrogalvanizing. Research was immediately carried out to devise means of electrodepositing zinc on continuously moving strip. Originally, the widths produced were under 20 inches, with the majority under 12 inches. It is believed that one steel company had a pilot line in the 30's devoted to electroplating wider strip. It was rumored that the process utilized insoluble anodes and the zinc content of the electroplating was maintained by cycling through a leaching and purification step, using low grade zinc ores and tailings as a source for zinc.

In 1939 a pilot line for tin plate installed at Weirton Steel Company was converted to plate zinc. For this, the Hubbell-Weisberg electrolyte was used, to which an ammoniacal zinc chloride complex was added. The outbreak of the war brought the experimental plating to a halt, but sufficient knowledge was gained to design a plating line for zinc-coating commercial strip. During the war, because of loss of ammunition boxes from rust, in order to provide corrosion resistance, electro tin plating lines were converted to produce electrogalvanized strip.

The electrolyte now employed for these lines in use is composed of zinc sulfate, sodium sulfate, magnesium sulfate and



(Left) Barrel plating unit at Western Electric's Indianapolis plant. Refrigeration unit at the left permits the use of higher than normal plating current per unit volume of solution. Control panel and barrel plating equipment in the center, centrifugal dryer at right. (Right) Close-up of the control panel and plating barrel.

sulfuric acid. The magnesium sulfate imparts luster to the plated surface, while the sodium sulfate acts as a conducting salt.

Design and construction of the various lines developed by several companies differ considerably. The two newest, designed originally for electroplating tin, are three story types where one side of the moving strip is plated at a time. The processing is arranged so that the initial bottom is coated in the first level, followed by a doubling back and flip-over of the strip in the second level where the original top is coated in the same manner as the bottom. Then the strip reverses onto the third level where rinsing and reclaim of electrolyte occurs. Roller contractors for electrical connection to the strip are used between each small plating cell. An older line plates both sides in a straight line operation, in which case many finger contactors are used to complete the electrical circuit.

The solutions are nearly always of the acid type using zinc sulfate or zinc chloride plus other salts to improve conductivity. However, each uses its own particular type solution, including cyanide electrolytes. Today, the anodes are nearly always 99.99 per cent pure zinc. The current is supplied at up to 12 volts by motor generators or rectifiers. On at least one line, 120,000 amperes are available for plating.

Now, new 400-foot-long electrolytic lines have revolutionized the production of electrodeposited zinc coated steel. Not only sheets, but whole coils of strip steel are rapidly and accurately coated with zinc. Production has increased tremendously, and control of quality can now be held to more precise tolerances. An interesting feature of these new electrodeposition processes is the central precision control systems that provide for a uniformity of quality never before possible in such large-scale operations. On one installation, an elaborate control board, two-way radio communication between various sections of the line, electric-eye inspection, and rapid delivery of test samples to the laboratory all help to keep the lines under constant control of skilled personnel.

Now, electrolytic zinc-coated steel sheet is produced by the most modern and advanced electroplating methods. As a result, the remarkably uniform coating offers tangible advantages in fabrication to assure end products of long life.

GENERAL ZINC ELECTROPLATING

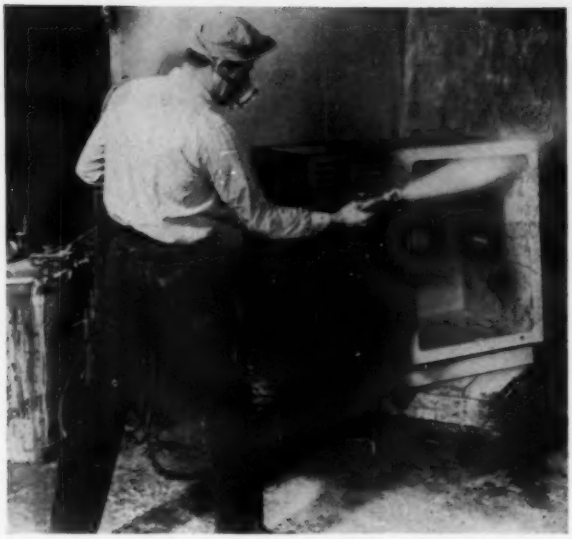
Zinc electroplating of parts of finite dimensions is carried out by different methods of handling—barrel and rack plating. In barrel plating, parts are handled in bulk, while in the rack method, pieces are handled separately by attaching them to a conducting fixture in the form of a wire, hook or clip.

In modern practice bolts, nuts, nails, screws, washers and small articles in general are commonly zinc plated by the barrel method. After the perforated barrel, which is made of non-conducting material, is immersed in the electrolyte, enough of the articles, properly cleaned, are loaded in the barrel to fill it partially. The parts are in contact with the flexible metal conductors on the inside of the barrel and together they form the cathode of the cell. The anodes are suspended in the electrolyte outside the barrel and occasionally positioned partially to encircle it. The barrel is arranged so that it turns about its longitudinal axis. As it slowly rotates, the parts are tumbled over one another continually, thus exposing fresh surfaces to the plating current and thereby assuming a uniform coating.

For larger parts that have to be individually handled, when volume is large enough, conveyor equipment is used to reduce costs. With this arrangement, products are moved by an endless chain or screw conveyor through all operations so that the only handling operations are those necessary to attach and remove them.

Today's mechanical devices and automatic equipment for zinc electroplating have indeed been developed to a high degree of efficiency. In the early days everything was done by hand. As mechanisms were developed and introduced, hand labor was gradually augmented or replaced. Now mechanical handling and processing equipment is available which operates partially or completely automatically so that very little operational attention is required.

Since the beginning of the century, equipment manufacturers for zinc electroplating have met production problems of every conceivable nature—some relatively simple, others so intricate as to need unusual, original and ingenious solutions. With improvements and new developments in plating apparatus, there have been commensurate advantages—increased and standardized production at lower cost; reduced labor requirements and labor turnover; increased salability of product through improved quality and finish, simplified and standardized solution equipment; reduced chemical and acid consumption; lower equipment upkeep, less unit and floor



Photograph Courtesy Weirton Steel Co.

Paint, lacquer, enamel, and other decorative coatings can be readily applied to electro-galvanized steel with assurance of long-time adhesion.

space; and with all clean, sanitary operating conditions. The characteristic features of design, construction, and operation of the equipment now available are based upon the most advanced principles of mechanical, electrical and chemical engineering. These principles are applied to meet actual operating conditions as they exist in everyday plant operations. New, fully automatic machines are in operation, designed for the whole zinc plating cycle—electric cleaner, cold water rinser, electrified acid dip, cold water rinse, cyanide dip, zinc plating cold water rinse or reclaim, cold water rinse, cold water rinse and spray, hot water, load and unload. Citing a representative installation, the parts to be processed are placed on the plating racks and carried to the zinc plating machine on a continuous conveyor. After plating, they are carried to the final assembly point by the same means of transportation. Electric current for the zinc plating tank is consumed at the rate of 8500 amperes at 6 volts. The electrocleaner tank requires 4000 amperes at 6 volts. Production and quality problems in the plating room are now reduced to a minimum as a result of the installation of such automatic machines.

Of course, the cycle will vary in accordance with the demands of the cycles previously discussed. The majority of electroplated zinc coatings run from 0.1 to 0.5 mil thickness. For outdoor applications, zinc coatings of 0.5 to 2 mils thick are applied. This type coating is usually preferred for close dimensional or threaded parts.

ZINC PLATED PENNIES

An interesting sidelight on zinc coated steel is that during World War II zinc-coated steel pennies were produced to save 4600 tons of copper normally used for the production of copper pennies. The pennies were made from steel sheet which had been zinc coated electrolytically. However, the electroplated zinc on steel sheets was also used as a satisfactory substitute for the more scarce materials nickel, tin, chromium among other strategic metals. According to an article which appeared in November 1942, "the zinc plated sheet is new in that pure zinc applied by an electroplating process to steel sheets has not been widely commercialized before."

SPECIFICATIONS

The first recorded specific studies by ASTM on electroplated coatings were started about 1927 by a Subcommittee on Hardware Specifications (now Subcommittee XIII). In this investigation steel articles of many shapes were coated by many methods including electroplated zinc. Specimens were exposed in several locations, including New York, N. Y., Sandy Hook, N. Y., Pittsburgh, Pa., State College, Pa. and Key West, Florida, and were inspected at intervals by interested members of the sub-committee.

However, because of certain circumstances, two years later a special study of electroplated coatings was carried out subsequently and exposure tests of electroplated steel were conducted under the direction of a joint committee consisting of representatives of ASTM Committee A-5, B-3 and B-6, and the Research Committee of the AES; the specimens to be prepared at the National Bureau of Standards. It was truly a cooperative effort. A simple system of rating on a logarithmic scale of 1 to 5, later modified to 10, was employed with special reference to the appearance and extent of rust. This system made it possible to draw objective conclusions, based on arithmetical averages of the successive ratings of electrodeposited zinc and other metallic coatings. The results of the exposure tests were published by the National Bureau of Standards. These results and knowledge gained by industry served as the basis for specifications for electroplated coatings that were first prepared by the joint committee in 1935 and have since been revised and extended.

Because the joint committee was made up of the representatives of the other groups previously mentioned, its official actions were sometimes cumbersome and slowed down. This dilemma was solved in 1941 by the formation of ASTM Committee B-8 on electrodeposited metallic coatings. Since then it has functioned successfully and effectively in maintaining specifications up-to-date.

The electro-process, whose coating is applied by means of electric power, offers continued promise of advancement as improved methods and equipment become developed. Not only is the prospect continually brightening in this respect, but with continued opportunity to replace manual handling of items to be coated, increased rates of production at lower production cost can be envisioned.

Tremendous studies have been made on the electroplating and electrogalvanizing of zinc, as evidenced by the replacement of large electric power generating units for the weak batteries first employed and the continued innovations and improvements of plating solutions. There is every reason to feel that further improvements will be forthcoming under this process.

Ernest W. Horvick graduated from Princeton University in 1935 as a chemical engineer. Before coming to the American Zinc Institute, he was with Weirton Steel Company, Bell Aircraft and Minneapolis Honeywell, in technical, supervisory and marketing capacities. He is a member of the American Chemical Society, the American Society for Metals, and the Society of Die Casting Engineers.

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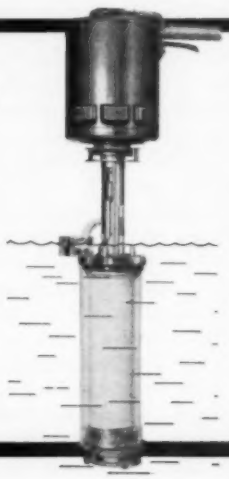

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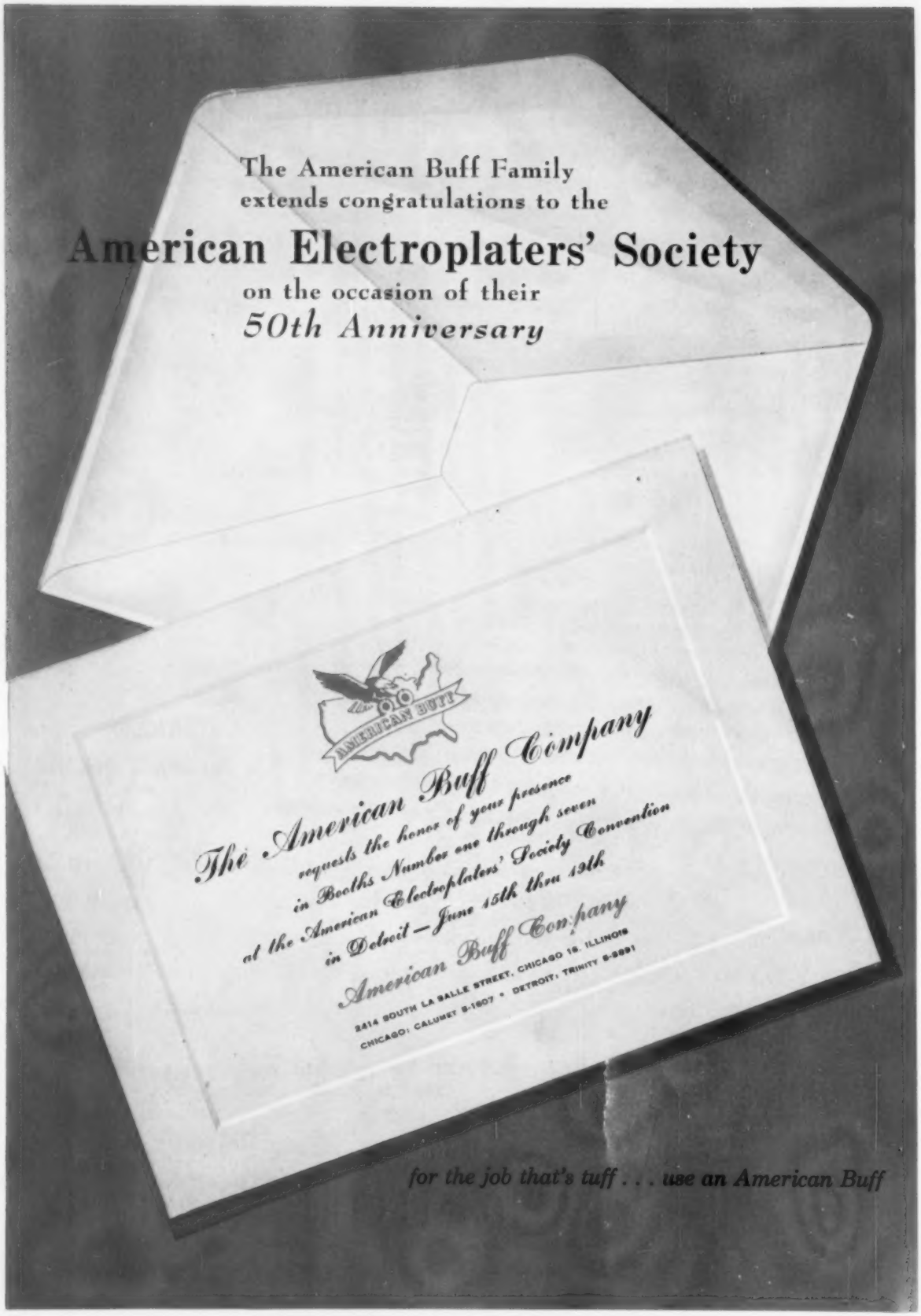
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extends congratulations to the
American Electroplaters' Society
on the occasion of their
50th Anniversary
The American Buff Company
requests the honor of your presence
in Booths Number one through seven
at the American Electroplaters' Society Convention
in Detroit — June 15th thru 19th
American Buff Company
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CHICAGO: CALUMET 5-1607 • DETROIT: TRINITY 5-5091
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WE HONOR

AMERICAN ELECTROPLATERS' SOCIETY, INC. (AES) honors these living or deceased, who by their vision and planning or participation, created and developed the National Electro-Platers Association of the United States and Canada (NEPA) in 1909 that was transformed into AES in 1913:

FIRST NEPA OFFICERS

Charles Henry Proctor	—President
John J. Farmon	—Vice President
Hugh Baxter	—Vice President
John W. Slattery	—Vice President
H. E. Willmore	—Vice President
Benjamin W. Gilchrist	—Secretary
Nathan S. Emery	—Treasurer
George B. Hogaboom	—Librarian

ADVISORY BOARD

William Schneider, Joseph Dimes, Horace H. Smith
Royal F. Clark, Richard Sliter

PRINTING COMMITTEE

George B. Hogaboom Justus A. Stremel
Harry C. Bernard

MEMBERS

C. S. Barber
Theodore Bartlett
Emil Blasset
Benjamin Brown
Percy S. Brown
William Bryer
W. E. Churchill
Frederick C. Clement
George W. Cooper
Herbert W. Cummings
E. B. Davidson
Otto DeMowitz
R. Downey
C. Dreher
Frank Duffy
F. Eberwein
Edward W. T. Faint
C. O. Field
William Fisher
J. H. Flanagan
W. J. French
Louis Gaenicke
John E. Grant
A. D. Havens
Oscar A. Hillman
J. F. Hubbs
J. M. Kerhart
Louis J. Krom
Palmer H. Langdon
William Lorch
William McConnell
James Meldrum
J. F. Meinke
W. C. Mills
Harvey Miller
Edward E. Newton
L. A. Peterson
Frederick F. Pierdon
A. J. Piper
William Reina
Franklin Sheldon
F. H. Speary
George O. Thompson
Thomas A. Trumbour
E. D. Van Arsdale
William Voss
George Whalen
C. D. White

KALEIDOSCOPE OF AES'S FIRST HALF CENTURY

IN THE onward sweep to its Centennial, the American Electroplaters' Society, Inc. (AES) has paused long enough at the halfway mark (1959) not only to observe its Golden Anniversary but also to measure and analyze its step-by-step growth and progress through the years, from its humble birth five decades ago as an educational institution entirely devoted to the advancement of electroplating and metal finishing, to its present estate as the half-century old Society still wholly dedicated to that very same mission.

So as to view AES's lifetime whole, it is naturally necessary to retrace steps along the pathway of time—back beyond today's atomic and space age—beyond World War II and America as the Arsenal of Democracy—beyond the New Deal as aftermath of our nation's most drastic economic depression—beyond the chaos of World War I—clear back to 1909, the first year of the administration of President William Howard Taft when the United States was a nation of 46 States with a population of scarcely 90 million.

And so as to understand our subject fully, it is then necessary to return appraisingly through those five eventful decades—back to AES in 1959: its Fiftieth Year of Life.

JOHN P. NICHOLS

ON March 6, 1909, in that era when the average salary of foremen platers was some $27.50 weekly, Charles H. Proctor, a farsighted New Jersey plating and foundry supervisor, achieved his long cherished dream by inspiring a meeting of some two-dozen foremen platers at the old Hotel Chelsea in New York City for the purpose of creating a non-profit association to foster the advancement of electroplating, metal finishing and allied arts.

Out of their thinking and planning, the National Electroplaters Association of the United States and Canada (NEPA) came into formal being at an organization meeting held at that same Chelsea Hotel, Saturday, April 10. There, with Charles H. Proctor, NEPA's first head presiding, the infant association's Constitution and Bylaws were approved by 60 Charter Members. NEPA was incorporated as a New York Corporation on October 18, 1909, the trailblazing ancestor of today's AES which it became in 1913 with George B. Hogaboom at the helm.

Graphically, AES burgeoned through the years as follows:

Kaleidoscope OF AES's FIRST HALF CENTURY

1909
NEW YORK THE PIONEER
TOTAL 1

1910
PHILADELPHIA BRANCH BORN
TOTAL 2

1911
ROCHESTER BRANCH FORMED
TOTAL 3

1912
MORE BRANCHES TORONTO INDIANAPOLIS (DIED 1933) DETROIT CHICAGO
TOTAL 7

1913
STILL MORE BRANCHES ST. LOUIS NEWARK MILWAUKEE DAYTON CINCINNATI BUFFALO (DIED 1915)
TOTAL 13

1914
NOW CLEVELAND BRIDGEPORT
TOTAL 15

1915
TOLEDO GETS ITS BRANCH
TOTAL 15

····· PATH OF HISTORY ····· WORLD WAR I ·

MILESTONES OF AES

1909—National Electro-Platers Association of the United States and Canada (NEPA) formed in New York City on April 10 with 60 Charter Members, the trailblazing ancestor of today's American Electroplaters Society, Inc., (AES). Incorporated as a New York corporation on October 18.

1910—First NEPA Banquet (January 15), forerunner of AES National Conventions. NEPA's QUARTERLY MAGAZINE inaugurated (June), progenitor of MONTHLY REVIEW and granddaddy of today's PLATING MAGAZINE.

FIRST DECADE

	CONVENTION	PRESIDENT
1913	New York, N.Y.	†Charles H. Proctor
1914	Chicago, Ill.	†George B. Hogaboom
1915	Dayton, Ohio	†H. J. Hansjosten
1916	Cleveland, Ohio	†Walter S. Barrows
1917	St. Louis, Mo.	†H. H. Williams
1918	Detroit, Mich.	†Walter J. Fraine
1919	Philadelphia, Pa.	†Walter J. Fraine

†Deceased

1912-
1913-
1914-
1918-
1920-
1923-
1925-

TENTH ANNIVERSARY
800 MEMBERS (EST)

TWENTIETH ANNIVERSARY
1500 MEMBERS (EST)

1916

NEW BRANCHES SYRACUSE (DIED 1924) PROVIDENCE (ATTLEBORO ADDED IN 1919)

TOTAL 17

1918

GRAND RAPIDS

TOTAL 18

1919

PITTSBURGH BRANCH BORN

TOTAL 19

1920

NOW READING (DIED 1926)

TOTAL 20

1921

BOSTON
WATERBURY
CONNECTICUT VALLEY (NOW HARTFORD)
MONTREAL

TOTAL 24

1929

NOW BALTIMORE-WASHINGTON
LOS ANGELES
WORCESTER (DIED IN 1933)

TOTAL 25

1930

SAN FRANCISCO
ANDERSON (IND) DIED IN 1938

TOTAL 27

19

SPRING
(MAS
BINGHA
ELMI
(DIED

TOT
2

I ..... VICTORY ..... PANIC ..... BOOM .. DEPRESSION AN

1912—NEPA becomes international with the chartering of its Toronto Branch. Third Annual Banquet includes first exhibit of suppliers' products.
1913—NEPA becomes today's AES. Adopts new Constitution and Bylaws. Conducts First Annual Convention (New York, June 1).
1914—"QUARTERLY REVIEW" becomes "MONTHLY REVIEW", daddy of today's PLATING.
1918—AES Research cooperation with National Bureau of Standards started.
1920—First female member admitted in AES.
1923—First Research Committee appointed with William Delage as Chairman.
1925—First AES Convention held outside of USA, namely Montreal, Canada.

SECOND DECADE

	CONVENTION	PRESIDENT
1920	Rochester, N.Y.	†Oscar E. Servis
1921	Indianapolis, Ind.	†Sylvester P. Gartland
1922	Cincinnati, Ohio	†Philip Uhl
1923	Providence, R.I.	Walter J. Allen
1924	Milwaukee, Wis.	†John E. Sterling
1925	Montreal, Canada	†Frank J. Hanlon
1926	Newark, N.J.	Edward J. Musick
1927	Toledo, Ohio	Frank J. Mesle
1928	Toronto, Canada	†John H. Feeley
1929	Detroit, Mich.	†Horace H. Smith

†Deceased

1929—AES spre
Branch
Resea
Bureau
1930—AES inc
profit e
1933—"MONTH
product
1944—AES pe
launchin
Heussne
Program
inaugura
universit
of exclu
Standar

THIRTIETH ANNIVERSARY
1900 MEMBERS (EST)

1936

SPRINGFIELD (MASS) BINGHAMTON-ELMIRA (DIED 1939)

TOTAL 27

1938

NEW HAVEN BUFFALO (NEW BRANCH)

TOTAL 28

1939

BINGHAMTON-SYRACUSE (BECAME SYRACUSE IN 1943)

TOTAL 28

1940

INDIANAPOLIS

TOTAL 29

1943

LANCASTER (PA.) SYRACUSE

TOTAL 30

JACKSON-LANSING (BECAME CENTRAL MICHIGAN 1954) AUSTRALIA (DIVIDED IN 1946)

TOTAL 32

ROCKFORD (ILL TWIN-CITY (MIN

TOTAL 34

ESSION AND NEW DEAL • DEFENSE PROGRAM ••• WORLD WAR II • VICT

1944

1945

1929—AES spreads to Pacific Coast with Branch in Los Angeles. First AES Research Project completed at National Bureau of Standards by W. P. Barrows.

1930—AES incorporated as New Jersey non-profit educational corporation.

1933—"MONTHLY REVIEW" carries its first product advertising (September).

1944—AES penetrates "Down Under" with launching of Australian Branch. C. E. Heussner initiates a new AES Research Program structure. Research projects inaugurated in American and Canadian universities and foundations instead of exclusively in National Bureau of Standards.

THIRD DECADE

	CONVENTION	PRESIDENT
1930	Washington, D.C.	†Horace H. Smith
1931	Rochester, N.Y.	†George Gehling
1932	Philadelphia, Pa.	†Philip Sievering
1933	Chicago, Ill.	†Clarence L. Van Dereau
1934	Detroit, Mich.	†Clarence L. Van Dereau
1935	Bridgeport, Conn.	H. A. Gilbertson
1936	Cleveland, Ohio	Thomas F. Slattery
1937	New York, N.Y.	†E. Steen Thompson
1938	Milwaukee, Wis.	Austin B. Wilson
1939	Asbury Park, N.J.	William M. Phillips

†Deceased

1946

1947

1948

1951

FORTIETH ANNIVERSARY
5220 MEMBERS

RD (ILL)
Y (MINN)
TAL
4

SYDNEY (AUSTRALIA)
MELBOURNE (AUSTRALIA)
ADELAIDE (AUSTRALIA)
ST. JOSEPH VALLEY (IND)
COLUMBUS (OHIO)
TOTAL
38

SOUTHEASTERN, INCLUDING ALABAMA, FLORIDA GEORGIA, MISSISSIPPI AND THE CAROLINAS
TOTAL
39

LOUISVILLE
SAGINAW VALLEY (MICHIGAN)
WESTERN ONTARIO
WINSTON-SALEM
(DIED IN 1949)
TOTAL
43

CTORY • RECONVERSION ..... PROSPERITY ... KOREAN STRUGGLE • A

ALLENTOWN-READING (PA)
HAMILTON (CANADA)
TOTAL
44

DALLAS-FORT WORTH
TOTAL
45

WICHITA, KANSA
KANSAS CITY
TOTAL
47

5 **1946** **1947** **1948** **1949** **1951** **1952**

946—Headquarters moved to Jenkintown, Pa. Then-President Walter L. Pinner awarded first "pot" of Order of Past Presidents.
947—AES's first Industrial Finishing Exposition conducted (Detroit). Society enters America's Southland with Southeastern Branch.
948—PLATING MAGAZINE succeeds "MONTHLY REVIEW" (January). AES's current Constitution and Bylaws adopted by Supreme Society and promulgated.
951—U.S.A.'s "Lone Star State" invaded by the formation of the Dallas-Fort Worth Branch. First Interim Meeting (Philadelphia).

FOURTH DECADE

	CONVENTION	PRESIDENT
1940	Dayton, Ohio	†Raymond M. Goodsell
1941	Boston, Mass.	Frederick Fulforth
1942	Grand Rapids, Mich.	Ellsworth T. Candee
1943	Buffalo, N.Y.	Charles C. Conley
1944	Cleveland, Ohio	George J. Wagner
1945	Pittsburgh, Pa.	Maurice R. Caldwell
1946	Pittsburgh, Pa.	Walter L. Pinner
1947	Detroit, Mich.	Frank K. Savage
1948	Atlantic City, N.J.	Kenneth M. Huston
1949	Milwaukee, Wis.	Samuel S. Johnston

†Deceased

1952—Nat
ark
1954—AES
tion
edu
1957—"AE
ado
AES
acc
for
Fisc
1958—Dr.
of

FORTY-FIFTH ANNIVERSARY
6381 MEMBERS

GLE • AMERICA'S GREATEST PROSPERITY •• RECESSION ••••••

ICHITA, KANSAS
KANSAS CITY
TOTAL
47
1952

PORTLAND, ORE.
TOTAL
48
1953

CAPITAL DISTRICT
(NEW YORK)
HOUSTON
SAN ANTONIO
SEATTLE
(PUGET SOUND
ADDED 1955)
SOUTHERN TIER
(NEW YORK)
TOTAL
53
1954

MISSISSIPPI
VALLEY
(IOWA)
TOTAL
54
1955

BRITISH COLUMBIA
MIAMI (FLORIDA)
MOHAWK VALLEY
(NEW YORK)
TOTAL
57
1957

BLUE RIDGE
(VA. & N.C.)
TOTAL
58
1958

1952—National Headquarters moved to Newark. Carl E. Heussner Award created.
1954—AES's Amended Certificate of Incorporation filed as a non-profit New Jersey educational corporation.
1957—"AES Scientific Achievement Award" adopted by the Supreme Society as AES's highest merit award. Tenure of accredited Delegates/Alternates fixed for specific annual twelve-month period. Fiscal year changed to July 1-June 30.
1958—Dr. William Blum named as first winner of AES Scientific Achievement Award.

FIFTH DECADE

	CONVENTION	PRESIDENT
1950	Boston, Mass.	Arthur W. Logozzo
1951	Buffalo, N.Y.	William J. Neill
1952	Chicago, Ill.	Cleveland F. Nixon
1953	Philadelphia, Pa.	†Franklyn J. MacStoker
1954	New York, N.Y.	George P. Swift
1955	Cleveland, Ohio	Ralph A. Schaefer
1956	Washington, D.C.	Clyde Kelly
1957	Montreal, Canada	Samuel Heiman
1958	Cincinnati, Ohio	Francis T. Eddy
1959	Detroit, Michigan	Herberth E. Head

†Deceased

AES IN ITS FIFTIETH YEAR ★★★★★
UNITED STATES ★ = 50 BRANCHES
CANADA ★★★★★ AUSTRALIA ★★★

ADELAIDE
ALLENTOWN-READING
BALTIMORE-WASHINGTON
BLUE RIDGE
BOSTON
BRIDGEPORT
BRITISH COLUMBIA
BUFFALO
CAPITOL DISTRICT
CENTRAL MICHIGAN
CHICAGO
CINCINNATI
CLEVELAND
COLUMBUS
DALLAS-FORT WORTH
DAYTON
DETROIT
GRAND RAPIDS
HAMILTON
HARTFORD
HOUSTON
INDIANAPOLS
KANSAS CITIY
LANCASTER
LOS ANGELES
LOUISVILLE
MELBOURNE
MIAMI
MILWAUKEE
MISSISSIPPI VALLEY
MOHAWK VALLEY
MONTREAL
WESTERN ONTARIO
NEWARK
NEW HAVEN
NEW YORK
PHILADELPHIA
PITTSBURGH
PORTLAND
PROVIDENCE-ATTLEBORO
ROCHESTER
WICHITA
ROCKFORD
SAGINAW VALLEY
ST. JOSEPH VALLEY
ST. LOUIS
SAN ANTONIO
SAN FRANCISCO
SEATTLE-PUGET SOUND
SOUTHEASTERN
SOUTHERN TIER
SPRINGFIELD
SYDNEY
SYRACUSE
TOLEDO
TORONTO
TWIN CITY
WATERBURY

AES IN 1959: *its fiftieth year of life*

AMERICAN Electroplaters' Society, Inc. (AES), as it observes its FIFTIETH ANNIVERSARY, has some 8000 Active, Sustaining and Student Members and Members-at-Large residing not only coast-to-coast in the United States but also in other countries.

Coordinated and serviced by its National Headquarters located in Newark, N. J., AES currently has 58 autonomous Branches each conducting educational and other Society activities in the common interest for its members. Fifty of these chartered Branches are located in the United States, 5 in Canada, 3 in Australia.

AES's Annual Convention attracts some 2000 such members and their families, and the technical papers presented at its educational sessions are published annually in a widely-sought book titled, TECHNICAL PROCEEDINGS.

Its periodic Industrial Finishing Exposition attracts many thousands from here and abroad to view the latest equipment and processes exhibited by the nation's leading electroplating and metal finishing suppliers.

Aside from its publishing activities, AES conducts an intensive research program embodying research projects on specific electroplating and metal finishing subjects financed by it in universities and foundations in the United States and Canada.

Its journal, PLATING MAGAZINE, enriches the technical knowledge of its readers. It has a global circulation at present aggregating some 10,000 monthly and is growing steadily.

AES's highest government, titled "Supreme Society," is composed of three Delegates from each of the AES's 58 Branches. National Officers, elected annually by the Supreme Society, comprise AES's Executive Board. Staff, directed by the National Executive Secretary who is also Publisher of PLATING MAGAZINE, is manned by specialists and practitioners.

And having thus marked its Golden Jubilee, AES proceeds full steam forward toward its Centennial, with present members aboard—and with thousands to be added enroute to 2009 AD—all for the service and benefit of electroplating, metal finishing and allied arts.

CONCEIVED AND CREATED BY JOHN P. NICHOLS ● 1959 AMERICAN ELECTROPLATERS' SOCIETY, INC., NEWARK, N.J.

AES HONORS ITS LIVING PAST PRESIDENTS

Edward J. Musick
1925–1926

Frank C. Mesle
1926–1927

H. A. Gilbertson
1934–1935

Austin B. Wilson
1937–1938

William M. Phillips
1938–1939

Frederick Fulforth
1940–1941

Ellsworth T. Candee
1941–1942

Charles C. Conley
1942–1943

George J. Wagner
1943–1944

M. R. Caldwell
1944–1945

Walter L. Pinner
1945–1946

Frank K. Savage
1946–1947

Kenneth M. Huston
1947–1948

Samuel S. Johnston
1948–1949

Arthur W. Logozzo
1949–1950

William J. Neill
1950–1951

Cleveland F. Nixon
1951–1952

Dr. George P. Swift
1953–1954

Dr. R. A. Schaefer
1954–1955

Clyde Kelly
1955–1956

Dr. Samuel Heiman
1956–1957

Francis T. Eddy
1957–1958

AES HONORS ITS LIVING HONORARY MEMBERS

Donald M. Bedwell

Dr. William Blum

Andrew W. Garrett

H. A. Gilbertson

John Lockerbie

Dr. Hiram Lukens

Frank C. Mesle

Edward J. Musick

William M. Phillips

Joseph P. Sexton

George J. Wagner

ANNUAL REPORT*

PRESIDENT'S REPORT

AMERICAN ELECTROPLATERS' SOCIETY, INC.

By

HERBERTH E. HEAD

FROM scratch and humblest beginnings a half-century ago, the American Electroplaters' Society, Inc. (AES) has grown through five ensuing decades entirely on the basis of service in fostering technical and scientific knowledge and advancements in electroplating, metal finishing and allied arts. As it observes its FIFTIETH ANNIVERSARY in 1959, it is composed of some 8,000 members. It has 50 Branches in the United States, 5 in Canada, 3 in Australia. It is solvent. It has heritage. Even greater challenge lies ahead. This reports on 1958-1959, bridge to that tomorrow.

HIGHEST AES GOVERNMENT

AES's highest government is its "Supreme Society," and this council that is the trustee of the Society's membership and architect of AES's governing policies is, in turn, composed of three accredited Delegates from each of the Society's 58 chartered Branches. The AES's 1958-1959 Delegates/Alternates elected by respective Branches and accredited by the Society's Credentials Committee composed of Past Presidents Cleveland F. Nixon, George J. Wagner and George P. Swift are listed elsewhere in this Annual Report and will sit in Annual Meeting in Detroit, June 18, 1959, during the AES's GOLDEN JUBILEE Convention. There, they will review the year's work and record, and will chart the Society's 1959-1960 program.

1958-1959 PROGRAM IN OPERATION

Supervised by the Executive Board composed of the elected officers of the AES, and administrative steward of the Supreme Society, the Society has had a full and productive GOLDEN JUBILEE year in 1958-1959.

Under its Educational Committee led by Chairman Dodd S. Carr, AES's educational program has made progress in 1958-1959, and it is expected that the new Speakers List upon which that Committee's special Sub-committee is at work will serve AES Branches even more helpfully when completed than its predecessor editions in scheduling sound and interesting educational sessions at Branch level. Another facet of its work lies in the field of electroplating classes, and the effectiveness of the program in this connection, now operative in numerous AES Branches, exemplifies the value of this medium in educational enrichment.

Intensive effort has been expended by the Publications Committee under Chairman Samuel Heiman in planning needed new textbooks in phases of electroplating and metal finishing, and among these are plans in the making for an eventual book on hydrogen embrittlement and a "primer" on electroplating.

The Editorial Board headed by Chairman John P. Nichols, has made a creditable record in assisting Editor Rodney Leeds in the procurement of worthy technical and scientific papers published, or to be published, in PLATING MAGAZINE, and it has supervised the programming of an expectedly outstanding International Conference on Electrodeposition and Metal Finishing that, at the GOLDEN JUBILEE CONVENTION in Detroit in June 1959, will feature eleven educational sessions embodying papers prepared by the experts of ten countries, including the United States, England, Canada, Australia, France, Germany, Holland, Switzerland, India and Italy. Special appreciation is due Past President Walter L. Pinner who, as Chairman of the International Council, Host Branch Convention Educational Chairman and a member of the Editorial Board, led an American and English Committee of the Council in framing this program under the aegis of the Editorial Board that is responsible, by AES Bylaw provision, for the educational sessions of Annual Conventions.

During the GOLDEN JUBILEE year, moreover, seven active research projects on specific phases of electroplating and metal finishing continued in operation under the direction of the AES's Research Committee and the active supervision of its District Supervisors and respective Project Committees. The Annual Report of that Committee's Chairman Russel E. Harr presented elsewhere in this document covers in fuller detail, the good record of AES's vital Research Program.

Herberth E. Head

EXECUTIVE BOARD IN ACTION DURING JUBILEE
Left to right: First Vice President Wysong; Past President Eddy; President Head; Second Vice President Wesley; Third Vice President Borlet; National Executive Secretary Nichols.

* AES's fiscal year was changed by the Supreme Society from April 1-March 31 to July 1-June 30, effective April 1, 1958. To adjust to the new fiscal year, a three-month Interim Period was instituted spanning April 1, 1958-June 30, 1958. AES then embarked upon its GOLDEN JUBILEE fiscal year spanning July 1, 1958 through June 30, 1959. So as to complete this report in advance of the Annual Meeting of the Supreme Society to be held in Detroit, June 18, 1959, and so as to publish it in the GOLDEN JUBILEE of PLATING MAGAZINE (June 1959), it necessarily covers the period ending March 31, 1959.

AES AWARDS AND HONORS

The second winner of the AES's highest scientific honor, namely its "AES Scientific Achievement Award" was selected during the year from among nominations of Branches, and announcement of the identity of that honored scientist will be made by Chairman Abner Brenner of the AES Scientific Achievement Award Selection Committee at the Opening Session of the GOLDEN JUBILEE Convention. At that same meeting, the Paper Awards Committee under Chairman Frank O. Beuckman will name the winners of the 1958-1959 AES Paper Awards, including the Carl E. Heussner AES Gold Medal, these being granted for excellence of technical and scientific papers on specific electroplating and metal finishing subjects published in PLATING MAGAZINE or in TECHNICAL PROCEEDINGS.

During the year, furthermore, an Honorary Membership Awards Committee headed by Past President Kenneth M. Huston, placed into operation, for the first time, the new procedure by which selection and election to coveted AES Honorary Membership is accomplished as a result of the so-called Hazucha Report spelling out this new method adopted by the Supreme Society at its Cincinnati Annual Meeting in May 1958. The qualifications of the selectees nominated by that Committee and ratified by the Executive Board will receive final consideration and action by the Supreme Society at its Annual Meeting, June 18, 1959. Award of Merit winners will also be named at that same meeting of the Society's summit governing council.

GOLDEN JUBILEE OBSERVANCE

Though the normal work of the Society continued to receive the concentrated attention of AES, including the continued emphasis placed upon publishing AES's flourishing PLATING MAGAZINE and publishing books of the caliber of TECHNICAL PROCEEDINGS (1958 Edition), the AES embarked simultaneously upon a comprehensive GOLDEN JUBILEE observance not only at national but also at Branch level. The blueprint thereof conceived and prepared by National Executive Secretary Nichols was approved last May by the Public Relations Committee, then by the Executive Board, finally by the Supreme Society. It was put into operation in July 1958 with creditable subsequent result.

Anniversary media, including the AES's history, are having international dissemination, and its symbolic material and visual aids, including the decalcomania of its GOLDEN JUBILEE insigne, are in wide use here and abroad. The Anniversary observance marking AES's fifty years of service to the public interest through its record in stimulating advancements in plating and metal finishing has brought greetings from government, industry, the press and other well-wishers, including many scientific and technical associations and societies with which the AES has, for years, proudly enjoyed cooperation in matters of mutual interest. And AES Branches and AES's regional groups have observed the GOLDEN JUBILEE with impressive educational and commemorative events at Branch or regional level. The fuller details of this Anniversary program are covered in the Executive Secretary's Report presented elsewhere herein.

These have inspired inquiries from non-members concerning AES membership. And to accommodate these, National Headquarters has published the booklet titled "AES Membership: Its Meaning to You." The booklet is also proving helpful to the Society's Membership Committee that, under Chairman Manuel E. Ben, is inspiring effort to increase Branch membership by at least a dozen worthy members per Branch during the GOLDEN JUBILEE.

FIFTIETH ANNIVERSARY CLIMAX

Climax of the Fiftieth Anniversary is, of course, the GOLDEN JUBILEE Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing already mentioned, that will concurrently be conducted by the AES in Detroit, Michigan, June 15-19, 1959 with the AES's Detroit Branch as Host. With Wright W. Wilson of that Branch as General Chairman and with a Branch Committee manned by functional experts, the Convention is expected to produce the largest attendance of members, their families and their guests in fifty years of AES. And under the leadership of Exposition Chairman Howard J. McAleer and Vice Chairman Manuel E. Ben, the Society confidently hopes to provide the largest exposition of latest processes and equipment of the industry's sources of supply ever staged by this industry—before the largest expected number of viewers.

IN CONCLUSION

To the Supreme Society for its confidence—to the Executive Board and the National Executive Secretary for their tireless cooperation—to the AES's regional and Branch leaders for their understanding and helpfulness—to the AES's liaison representatives and to the many members who have participated in the work of the Society's numerous functional committees—to the National Headquarters and PLATING MAGAZINE staff that, by the quantity and quality of its accomplishments, has made AES so proud of it—to all of these—many thanks for making this administration, in AES's GOLDEN JUBILEE year, an effective one. Openly, I want to thank the Chrysler Corporation for making time and funds available in carrying out the duties of this office. It has been a privilege and an honor to serve as your President during this eventful period.

AN AES BRANCH GRADUATES ITS ELECTROPLATING CLASS

Above some of the graduates of the Newark Branch's Electroplating Class who received diplomas at the Commencement Exercises conducted at the Hotel Robert Treat, Newark before a large Branch audience. Newark's school is one among many now being conducted by AES Branches.

FIRST VICE PRESIDENT'S REPORT

by

Ralph D. Wysong

EDUCATION, the assimilation of knowledge and the dissemination thereof, continues to be the main reason for the existence of our growing Society, and for this reason, the activities of the Educational Committee contribute greatly to its well being. This Committee's objectives as set forth in its Bylaws are many and varied, but they all point toward helping the Branches put on the best possible program for their membership.

The Speakers' List is being revised to include a short abstract (50-100 words) of the talks to be presented by the various speakers. This should be a great assistance to the Librarians when choosing the speakers for the year. The Branch Officers' Manual section on Electroplating Courses is also being revised to include recent additions of films and literature that are now available.

It has been said many times, but will always bear repeating, "Our Society depends upon its Branches and is no better than the Branches." With this in mind, it can also be said that "No Branch is any better than the monthly program it gives to its membership." A top-notch Educational Program will bring out the membership, and when members are satisfied with the program, they will bring their friends and associates. Our Society can only go forward on a high-level Educational Program. The Educational Committee stands ready to be of assistance to any Branch to help it achieve this goal.

ORGANIC FINISHING

Interest in Organic Finishing has reached a new peak in this, our GOLDEN JUBILEE YEAR. Many Branches have again used this theme for one or more of their monthly meetings, and the Milwaukee Branch continues to make history and "hay" with their dual sessions.

For the first time since this subject has been seriously explored, our PLATING MAGAZINE has six excellent articles in the March issue with several extras which will appear in subsequent issues. All this in our Jubilee Year, when eleven of the forty-five papers and three of the eleven sessions at our June Convention will be devoted to Organic Finishing! Yes, Organic Finishing has truly come of age in our Society.

All the efforts of the Executive Board, the Committees and your Branch Officers are pointed toward a common goal, the assimilation and dissemination of information for the benefit of the membership.

Dr. W. Andrew Wesley

Ralph D. Wysong

IN CONCLUSION

During the past year, your First Vice President has been regular in attendance at all Executive Board meetings and has been privileged to attend many Branch and Regional meetings. Our experience in attending varied meetings has proved so enjoyable and enlightening that we would like to urge others not only to attend your own Branch meetings, but also make up a carload of members and enjoy the hospitality and educational program of some neighboring Branch.

We wish to express our appreciation to the Studebaker-Packard Corporation for their cooperation during the past couple of years, and to AES membership, our thanks for having allowed us to serve you.

SECOND VICE PRESIDENT'S REPORT

by

Dr. W. Andrew Wesley

THE wisdom of the Supreme Society in establishing a permanent AES Membership Committee in 1957 has been well borne out by the greater activity and interest shown in promoting the growth of our Society this year. Our individual membership total has not suffered significantly despite the 1958 business recession.

The problem posed by the large numbers of suspensions which occur too regularly in the Branches is being studied intensively. Your Second Vice President believes that there is no cause for alarm in this. The number of suspensions per-hundred new members elected could undoubtedly be reduced by making the requirements for election more severe. Under the present system the weeding out of persons not sincerely interested in the aims of the Society occurs after election. Their failure to attend Branch and regional meetings demonstrates this lack of interest. It is generally followed by delinquency in payment of dues.

It is doubtful that attempts to carry out this weeding process prior to election would give a better net result in the long run. Instead, the Membership Committee should concentrate on ways and means to impress newly elected members with the importance of the Society's goals and the value of their membership in it.

MEMBERSHIP PROMOTION

The publicity accorded to the GOLDEN JUBILEE of the Society is reaching large numbers of non-members with the message that the AES is important; that it is now

mature and vigorous; that it is recognized internationally as the spokesman for the American, Canadian and Australian finishing industries; that a large fraction of the important developments in this field over the past 50 years came from AES members or were brought to light in our publications; that to keep up-to-date one must attend the Branch, regional, national and, indeed, international meetings; and, finally, that if one wants to get to know the leaders of the industry, he will find them at AES functions.

The Membership Committee has implemented the Executive Board's project which set a goal of twelve extra new members in each Branch during the period from January 1 to June 30 of AES's Golden Anniversary Year. The Committee is also completing plans to establish a new kind of membership promotion activity. This is to be associated with regional AES meetings.

Under a plan suggested by Louis V. Gagnon of the Boston Branch, "promotion workshop sessions" are to be organized by a group appointed by each Regional Committee, with a Chairman, an Advisor from the AES Membership Committee and a local Secretary. All members of Branch membership committees in the region will take part in such workshops. They will separate into discussion groups of four to six people with a single topic for each table dealing with a facet of the membership promotion task. Finally, the groups will reconvene as one body and discuss the results of the small conferences.

Another proposal of the Membership Committee is that membership activities at the Branch level be handled by a permanent continuing committee with its own chairman rather than by a committee which changes each year.

SUSTAINING MEMBERSHIPS

In contrast to the record on individual memberships there has been a serious slump in the number of Sustaining Members. During the fiscal year some 22 companies have dropped membership. Some of these will lose interest in our Research Programs, perhaps never to return. Others dropped out only because of a serious but temporary financial situation. These will come back into the fold soon if the Branch committees will keep in touch with them.

Why are Sustaining Memberships so important to the AES? It is because each one represents not just an individual but a group of people, a company, a segment of our industry. If the head of a company is allowed to conclude that it is not essential to keep the Research Program going, he will also be apt to think it is not important for his platers and chemists to be members and to attend our meetings. We must keep the advantages of AES membership alive before these firms. We must not let industry forget that where research stops, competition takes over and decay sets in.

PROGRESS IN BRANCHES

The following Branches have been declared winners of the annual Membership Promotional Awards for greatest percentage net increase in membership: 1) Branches with 126 or more members: Melbourne; 2) Branches with 70 to 125 members: Southeastern; 3) Branches with 69 or less members: Portland.

It is very pleasant and encouraging to be able to report that organizational meetings have been held in Denver, Colorado and in Phoenix, Arizona aimed at setting up new Branches of the AES in these cities. With these new Branches in prospect and the adjacent existing Branches, it appears likely that the Society will have in the near future a very live new Western Regional District. To these groups and their future: "Good fortune and Godspeed!"

IN CONCLUSION

Attendance at Executive Board Meetings, discussions with officers of the various Committees which are planning conventions, regional and interim meetings, and individuals met at Branch, regional and national meetings, all these contacts continue to impress your Second Vice President with the tremendous vitality of the AES, and the amazing degree to which members all over the country are dedicated to the aims of our Society. It is a privilege to play an active role in these important affairs.

THIRD VICE PRESIDENT'S REPORT

by
Chester G. Borlet

YOUR Third Vice President, under the Bylaws of the American Electroplaters' Society, is a member of the Branch Exhibit Awards Committee and performs such other duties as may be assigned to him by the President or the Executive Board.

EXHIBIT AWARDS

During the year, your Third Vice President, by Board assignment, spearheaded the Board's work with respect to Branch exhibits at the GOLDEN JUBILEE Convention. So as to enable the Board to effectuate policy in this matter, all Branches of the Society were polled to determine whether or not sufficient Branch interest in the project existed to warrant Board creation of a Branch exhibit program. The final results of the poll found 10 Branches desiring to exhibit—23 expressed themselves as having no interest—25 indicated "no interest" by failure to reply. This evident Branch disinterest in exhibiting during an Industrial Finishing Exposition year, caused the Board to refrain from setting up a formal Branch exhibit project in 1959.

The Board did, however, hold that those Branches wishing to present an exhibit should have free space available. Consequently, arrangements were made with the Exposition Chairman to provide such Branches with free space required on direct request. It was specified to such Branches that no cash prizes would be provided by the Society and that such Branch exhibits must be entirely educational, and definitely not commercial.

AES LAW AMENDMENTS

The President also assigned me the duty of performing certain work of a specific nature on AES Constitution and Bylaw revisions. And during the year, a number of Constitutional and Bylaw amendments either have been finalized by direction of the Supreme Society or have been proposed by the Board so as to streamline those instruments.

First, the final language of Supreme Society amendments of Part I Article II Section 7 and Article III new Section 15 of the AES Bylaws relating to Honorary Membership was completed by the Law Committee as directed by the Supreme Society. The results were reviewed and approved by the Board and have properly been woven into the Bylaws.

Next, two amendments to the Constitution were sponsored by the Executive Board and have been published in PLATING MAGAZINE for consideration at the Supreme

Chester G. Borlet

Society's June Annual Meeting. The first proposes amendment of Part I Article V Section 2 so as to exempt Honorary Members from the payment of dues. Enactment of this revision would bring us in agreement with other professional Societies. The second proposes amendment of Part I Article IV Section I so as to state that ". . . All other officers of the Society, except the Past President, shall be elected." Ratification here will correct a mere technicality.

A number of Bylaw revisions have been presented to the Executive Board and have been approved by it for reference to the coming Supreme Society Annual Meeting. Briefly, these proposed amendments include:

1. Interim Meetings—Set the time and place of the Interim Meeting of the Supreme Society sufficiently in advance so that annual Branch meetings may not interfere.
2. Branch Exhibits—Allow the Executive Board to determine when Branch exhibits shall be held, and under its direction.
3. Payment of Per Capita Tax—Change the Per Capita Tax due-date from December 1 to September 1. This alteration proposed by the recent Sixth Interim Meeting of the Supreme Society held in Atlanta, is needed so that, under AES's new fiscal year, PLATING Magazine can continue effectively to comply with the rules and regulations of the Audit Bureau of Circulations.

It might be added that the Sixth Interim Meeting also proposed increase in Per Capita Taxes, effective July 1, 1959, from $5.70 to $10.00, and at least four Branches have together invoked the AES's Constitutional provisions to bring that proposed increase before the Supreme Society's Annual Meeting for consideration.

In Memoriam

ASIDE from its Founding Fathers and the multitude of members who died since its creation a half-century ago, American Electroplaters' Society, in this its FIFTIETH ANNIVERSARY year, also mourns the loss of the following members who passed away during 1958–1959. Their devotion to the Society and their contributions to its progress will long honor their memory.

FOUNDERS AND HONORARY MEMBERS

Thomas A. Trumbour (New York)

PAST NATIONAL PRESIDENTS

Franklyn J. McStoker (New York) 1952–1953

MEMBERS

BOSTON:
Dr. Ernest D. Wilson

BUFFALO:
Willis M. Fotheringham

CHICAGO:
V. C. Anderson,
Eugene Gryles,
Joseph Trezek

COLUMBUS:
James E. Brown

DALLAS-FT. WORTH:
Elman V. Adams

DAYTON:
Thad N. Kisor

DETROIT:
Theodore N. Gassen,
N. L. Goodwin

GRAND RAPIDS:
Donald T. Barrett

HOUSTON:
F. H. Kellner

INDIANAPOLIS:
M. E. Steuernagel

LOS ANGELES:
Harold Kroesche,
Anthony Rickman

MILWAUKEE:
Raymond F. McGuire

MOHAWK VALLEY:
Herman Schnurr

MONTREAL:
Laurent Daigneault

NEWARK:
Joseph Cirelo,
Louis Donroe,
Van Winkle Todd

NEW HAVEN:
Frank Simione

NEW YORK:
Anthony Henry,
Louis Schwartz,
William Voss

ST. LOUIS:
Charles T. McGinley,
Paul E. Miller,
Carl Sommers,
Eugene S. Weil

SPRINGFIELD:
Calin Hostie

TWIN CITY:
Mark Murphy

WATERBURY:
William Gaunt

WESTERN ONTARIO:
Glen Watson

IN CONCLUSION

Your Third Vice President attended nine annual Branch meetings and four regular meetings. These certainly provided a great deal of satisfaction and pride to see, first hand, the vast amount of work and effort each Branch, large or small, extended so as to do its share in making the Fiftieth Anniversary a tremendous success. Afforded the opportunity of meeting such men who are active in their Branch cooperation with this great event, and there were many; demonstrated that our Society abounds with leadership material. Equally evident was the fact that we must ever be on the alert to recognize men with such high potential and develop them into leaders.

It has been a distinct privilege and honor to have served during this great Fiftieth Anniversary year as your Third Vice President.

PAST PRESIDENT'S REPORT

by
Francis T. Eddy

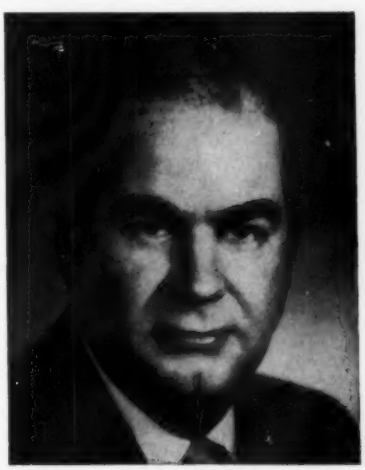
IN WRITING this last report as an officer of the American Electroplaters' Society, it is with a great deal of pleasure that I look back over the last five years.

The Society is made up of people and the contacts that I have had with these people over the years have been stimulating and satisfying. In the business of the Society, there has not always been agreement, nor should there be. Problems of the Society have been discussed and opinions stated always with the sincerity of the persons' thoughts and convictions. I believe this has definitely been to the benefit of our Society and industry.

In the meetings and actions of the Executive Board, one factor has always been dominant—devotion to duty. From George Swift to Chet Borlet, all the officers of the Society during my tenure, have shown, with emphasis, this quality of devotion. It has been a really inspiring experience to find the many varied actions and opinions tied together with this common virtue.

My thanks go to every member of the Society for his help, guidance and understanding during my years on the Board. I was very fortunate to have been afforded this opportunity to serve you and the Society.

In the future, as always, the success of the Society depends on the individual. Each member should be proud, as I am, of his heritage of the past. He should also accept his responsibility for the years to come.



Francis T. Eddy

EXECUTIVE SECRETARY'S REPORT

by

John P. Nichols

ARRIVAL of the American Electroplaters' Society, Inc. (AES) at its FIFTIETH ANNIVERSARY has not only enabled it to evaluate its half-century growth and give visible thanks for its progress through suitable GOLDEN JUBILEE observance at national, regional and Branch levels but also to apply the lessons learned from its yesterday to help meet the challenges of its today and its tomorrow.

STATURE AT AES'S HALF-CENTURY MARK

As it observed its GOLDEN ANNIVERSARY in 1958-1959, AES, quantitatively, had nearly 8,000 members, in all classifications, residing globally. The bulk of these are Active Members composing the Society's current 58 chartered Branches. Five of these Branches are in the Dominion of Canada. Three are in the Commonwealth of Australia. Fifty are located in the United States, spread from coast-to-coast and border-to-border. At least three more American Branches are currently in the process of formation.

Moreover, 26 of today's AES Branches are respectively grouped into five regional organizations, namely the Midwest Group; the Tri-State Group; the Empire State Group; the New England Group, and the Dixie Group that hosted the Supreme Society's Sixth Interim Meeting in Atlanta, Georgia, February 14, 1959. A sixth regional group is now in the planning stage encompassing the Dallas-Fort Worth, Kansas City and Wichita Branches.

COMPLEXITIES OF GOLDEN JUBILEE YEAR

AES entered its FIFTIETH ANNIVERSARY on the tide of a change in its fiscal year. To adjust to the new fiscal period of July 1-June 30 from April 1-March 31, it had to interpose a three-month Interim Period, namely April 1, 1958-June 30, 1958, then embark upon its new twelve-month fiscal year on July 1, 1958 spanning through June 30, 1959. So as to effectuate this transition, AES members paid per capita taxes, this one time, for the fifteen-month period, namely April 1, 1958 through June 30, 1959. AES Branches and Members-at-Large rose to the occasion.

John P. Nichols

It is manifestly impossible at this stage of the fiscal year, to marshal a complete financial statement for the period ending June 30, 1959. Such a certified financial statement for AES/PLATING MAGAZINE/Research Program will, of course, be provided after audit by Clyde A. Zukswert & Co., certified public accountants, and will be published in the September 1959 issue of PLATING MAGAZINE.

The following, meantime, portrays AES/PLATING MAGAZINE operating performance (not including AES Research Program) during April 1, 1958 through March 31, 1959, latest twelve-month period for which data are available as this is written, and compares that record with three preceding corresponding periods:

	INCOME	EXPENSE
April 1, 1955–March 31, 1956	$203,158.83	$211,629.30
April 1, 1956–March 31, 1957(*)	$211,635.97	$211,616.76
April 1, 1957–March 31, 1958(*)	$204,805.25	$205,782.92
April 1, 1958–March 31, 1959(*)	$188,237.31(A)	$205,026.41

(A) Includes four quarters per-capita taxes and Member-at-Large dues.

*Tenure present Headquarters Management from June 1, 1956.

In digesting the foregoing four-year statement that includes the period since Autumn 1957 steeped in 1) business recession attended by retrenchment and caution by many companies that direly

(Photos by Andrew Catchmark, Chrysler Corp.)

Aside from the yeoman planning and effort provided by the Detroit Branch leadership and by the industrious, expert, functional committees of that Branch, veteran of four prior AES Annual Conventions and pioneer of AES Industrial Finishing Expositions, there is also need for national coordination in any such mammoth enterprise as AES's GOLDEN JUBILEE Convention and Finishing Exposition including the International Conference on Electrodeposition and Metal Finishing, that will concurrently be held in Detroit, June 15-19, 1959. Above left, one such Detroit coordination meeting. (LEFT) Left to right: General Convention Chairman Wright W. Wilson; International Conference Chairman Walter L. Pinner; National Executive Secretary John P. Nichols: First Vice President Ralph D. Wysong; National President Herberth E. Head and Housing Chairman William P. Katke. (RIGHT) A dinner meeting of the Detroit Branch Executive Group with National Officers as guests. Clockwise from left: Francis T. Eddy, Chester G. Borlet, James D. Thomas, Leland M. Morse, Frederick Olmstead, Ralph D. Wysong, Edward J. Kubis, John Hitchcock, Branch President Manuel E. Ben, Robert C. Trees, Wright W. Wilson, John P. Nichols, National President Herberth E. Head, Vincent Cassidy and Glenn Friedt.

affected the advertising performance of most publications, including PLATING MAGAZINE and 2) swelling operating costs, result of upward spiralling inflation nationally, it is to be noted that as against an operating deficit of $977.67 for the twelve-month period April 1, 1957-March 31, 1958, AES/PLATING had an operating deficit of $16,789.10 for the twelve-month period, April 1, 1958-March 31, 1959, both deficits attributable to advertising revenue decreases.

FIFTIETH ANNIVERSARY IN TERMS OF SERVICE

In all other respects, 1958-1959, AES's GOLDEN JUBILEE Year, has been a record year of performance.

Branch Members have benefitted from the thriving educational and other activities of AES's larger Branches in the United States, Canada and Australia, and from the expanding accomplishments of the Society's dynamic smaller Branches that, by performance, are growing larger.

Members of all kinds, wherever located, have been educationally enriched by a burgeoning PLATING MAGAzine, and by TECHNICAL PROCEEDINGS, Research Serial Reports and other elements of AES's publishing activities.

Branches have been assisted in membership expansion by the work and inspiration of AES's new Membership Committee, and Branches and their members have been, or will be, the beneficiaries of the activities of the Society's new Educational Committee, Publications Committee, Branch Exhibit Committee and of other such task forces of the Society.

AES has been aided in keeping itself coordinated and well-functioning by such of its elements as the Law Committee; Credentials Committee; AES Scientific Achievement Award Committee; Honorary Membership Award Committee; Paper Award Committee, others.

Under the direction of the Research Committee, moreover, AES's vital Research Program has continued making headway with seven active Research Projects now in operation at respective universities and foundations here and in Canada. The undertaking of three specific additional research projects, furthermore, is currently in prospect.

And assists by its livewire Editorial Board have enabled AES to swell PLATING MAGAZINE's reservoir of original technical, scientific, practical plating and organic coating papers to near-capacity level.

Years ago, AES recognized the worth and significance of cooperation, and today its relationship of mutuality with other technical, scientific and professional Associations and Societies in matters of common interest, and with others dealing with it, is among the Society's most-prized assets. Good private relations are the very essence of good public relations. And as Abraham Lincoln said, "With public sentiment nothing can fail; without it, nothing can succeed."

AES'S GOLDEN JUBILEE PROGRAM

By action of the Supreme Society's Annual Meeting held at the Cincinnati Convention, May 22, 1958, AES launched its year-long FIFTIETH ANNIVERSARY observance on July 1, 1958. Programmed for large educational and institutional impact on an international scale, the GOLDEN JUBILEE has produced noteworthy public relations results in further heightening the prestige of the

PLATING MAGAZINE's July 1958 issue that, blazoning the GOLDEN JUBILEE insigne, launched AES's FIFTIETH ANNIVERSARY observance.

AES, its Branches, its Research Program, its PLATING MAGAZINE, specifically, and in broadening public awareness of electroplating, metal finishing and allied arts, generally.

In briefest highlight, AES applied these public relations tools to create, cumulatively, the public attention and good will that will reach apex with the Anniversary program's climax events, namely AES's Golden Jubilee Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing, to be held in Detroit, Michigan, June 15-19, 1959 with AES's Detroit Branch as host.

1. AES's HISTORY MARSHALED:

The history of an organization is essentially the mainstay of its Anniversary media. AES's half-century biography has been depicted in two ways, 1) narratively through "MILESTONES OF AES" and, 2) graphically via its unique "KALEIDOSCOPE OF AES's FIRST HALF-CENTURY." The former was published serially in PLATING MAGAZINE over a nine-month span—the latter is a feature of PLATING's vaunted GOLDEN JUBILEE ISSUE.

Both elements were then joined to fashion AES's documentary booklet, also titled "MILESTONES OF AES," now issuing to an international list, specially prepared, comprising scientific and technical publications; newspapers and magazines, particularly in AES Branch communities; municipal and university libraries; technical, scientific and other university educators, including university and college presidents; Chambers of Commerce and other such civic educational bodies in communities served by AES Branches; technical, scientific and professional Associations, Societies and Foundations; Governors and Mayors of States and municipalities in which AES Branches are domiciled; many others of similar significance. As an expression of respect and esteem,

Rodney Leeds
Editor

Mrs. Ann Marsh
Office Manager

Thomas W. Lowe
Production Manager

The AES booklet that is providing AES membership data to the flow of inquiries mainly resulting from the GOLDEN JUBILEE observance.

the booklet's very first copy was sent to President Dwight D. Eisenhower.

2. SYMBOLIC MEDIA EMPLOYED:

Designed by National Headquarters, the GOLDEN JUBILEE insigne has been the widely employed symbol of AES's FIFTIETH ANNIVERSARY. Imprinted on National Headquarters and Branch stationery; on PLATING MAGAZINE covers; in advertising; on envelopes; on flags; on decalcomania; on printed programs; on book and booklet covers; in numerous other effective ways, the symbol has eloquently told the story of AES and its GOLDEN JUBILEE globally, and has helped visit greater public awareness upon electroplating and metal finishing as sciences advancing the public interest.

Decalcomania, for instance, were issued free by National Headquarters to every Active, Honorary, Student and Sustaining Member and Member-at-Large, internationally, and most recipients have been using them on their automobiles in the United States, Canada, Australia, Europe, South America and elsewhere.

Furthermore, AES's two large GOLDEN JUBILEE ceremonial banners have traveled the circuit of Branch events for nearly a full year, and have effectively been used in hotel lobbies, in banquet halls and as dais backdrops at AES meetings and educational sessions thus contributing GOLDEN JUBILEE background and aura to these many Branch events.

3. GOLDEN JUBILEE SPECIAL EVENTS:

Enthused and aided by a GOLDEN JUBILEE promotional kit prepared and issued by National Headquarters to each Branch Secretary early in July 1958 containing practical program format, suggestions and ideas, many AES Regions and Branches fashioned outstanding educational and other GOLDEN JUBILEE events spaced over the Autumn, Winter and Spring seasons, thereby producing cumulative impact. Among many such events, special mention is deserved by the GOLDEN JUBILEE Stag Day of the Detroit Branch in July; by the GOLDEN JUBILEE Outing of the Southern Tier Branch in August; by the Annual Meetings of the Newark and Philadelphia Branches in December; by the GOLDEN JUBILEE Christmas Party of the Detroit Branch in December.

Commendation is also due the Chicago and Cleveland Branches for their January Anniversary programs, and to the Grand Rapids Branch for its FIFTIETH ANNIVERSARY affair that not only prompted that City's fathers to proclaim January 12, 1959 as "American Electroplaters' Society GOLDEN JUBILEE Day in Grand Rapids" but which also inspired the City's Mayor to present the key to that City to AES's National President.

Compliments are also due AES's Dixie Region generally and its Southeastern Branch particularly for the impressive two-day GOLDEN JUBILEE educational sessions, program and banquet staged in Atlanta, February 13-14, this two-day span having been proclaimed by Atlanta's Mayor as "American Electroplaters' Society GOLDEN JUBILEE Days in Atlanta."

Special mention is also deserved by the New York Branch, AES's Mother Branch, for the memorable educational program and commemorative staged in New York, February 7, and to the Anniversary events of AES's Dayton and Rockford Branches. It is noteworthy that Dayton Branch's banquet on "AES GOLDEN JUBILEE DAY IN DAYTON," proclaimed by Mayor R. William Patterson, was attended by over 500 Branch members and their guests.

Anticipated as this is written is the ingenious GOLDEN JUBILEE educational session and AES commemorative being fashioned by the Baltimore-Washington Branch in Washington, D. C., for staging April 11. Others in substantially similar category are the Empire State, Tri-State and New England Regional affairs soon to be held, and the Los Angeles, Pittsburgh, Milwaukee and Boston Branch programs that will help set the scene for the GOLDEN JUBILEE CONVENTION, climax of AES's FIFTIETH ANNIVERSARY observance.

Miss Kathryn H. Langan
Office Accountant

Ralph F. Scholbe
Advertising Manager

Mrs. Loretta Ehrhardt
Advertising

REMINISCENCES OF AES GOLDEN JUBILEE OBSERVANCE

(1) Southern Tier Branch's Golden Jubilee Outing, August 1958. (2) Detroit's Golden Jubilee Stag Day, July 1958. (3) Montreal's Golden Jubilee Banquet. (4 & 5) Scenes at Newark Branch's Golden Jubilee Christmas Party. (6, 7, 8) New York (Mother Branch) Mammoth Anniversary Observance. (9) Philadelphia Branch repossesses its 1910 Charter, November 1958. (10 & 11) Scenes at the Golden Jubilee Observance in Dixie (Atlanta, February 1959). (12) Golden Jubilee in Grand Rapids. (13) Mayor Stanley J. Davis delivers key to City of Grand Rapids. First Vice President Wysong receiving in behalf of AES. (14) President Head receives gold-plated gavel from Dixie Region. Southeastern President Claude J. Nalley presenting. (15) Intent Delegates at Sixth Interim Meeting, Atlanta, February 1959.

REMINISCENCES OF AES GOLDEN JUBILEE OBSERVANCE

1) The head table at the gala Banquet of the proclaimed two-day GOLDEN JUBILEE event staged by the Dixie Regional Council at the Dinkler-Plaza Hotel, Atlanta, Georgia, February 13-14, 1959 with the Southeastern Branch as Host Branch. 2) A part of the audience of over 500 persons at the GOLDEN JUBILEE event of the Dayton Branch, March 7, 1959. 3) Two of AES's five living Charter Members honored at the New York "Mother" Branch's half-century commemorative, Statler Hotel, New York, February 7, 1959. Left to right seated, Mrs. Stremel, Charter Members Justus A. Stremel and Harry C. Bernard. National President Head and some other AES leaders in background. 4) A table at the Newark Branch's Fiftieth Anniversary observance event December 13, 1958. 5) Presentation of the traditional "POT" of the Order of Past Presidents to National President Head (left). Past President K. B. Huston presenter. 6) A view of the Educational Sessions phase of the Rockford Branch's GOLDEN JUBILEE event, March 7, 1959. 7) National Officers congratulate President Head, April 11, 1959, at Baltimore-Washington's memorable GOLDEN JUBILEE event, Washington. 8) Charter Member F. F. Pierdon receives ovation at that Washington event. 9-12) Scenes at the Empire State Regional Group's GOLDEN JUBILEE affair, Buffalo, April 11, 1959. 13) A view of Tri State Regional's acclaimed Jubilee affair, Louisville, April 4. 14) Three generations of AES Pierdons, stalwarts of the Baltimore-Washington Branch, at Washington party, April 11. 15) Scene at the Educational Sessions of that Washington event.

4. PLATING MAGAZINE: JUBILEE'S CLARION:

Mainstay in disseminating AES's Anniversary story to the largest global paid circulation in this field—including news and promotional coverage of GOLDEN JUBILEE educational and other events and the GOLDEN JUBILEE Convention, Exposition and International Conference—is, of course, AES's own monthly PLATING MAGAZINE. Twelve successive monthly issues, each gaining large momentum that will reach zenith with PLATING's vaunted GOLDEN JUBILEE ISSUE, have already contributed vastly to the accomplishment of the GOLDEN JUBILEE's mission.

As a further step, PLATING embraced the FIFTIETH ANNIVERSARY as occasion to express its appreciation to its many advertisers for their confidence in PLATING MAGAZINE demonstrated by their long-time and continuing employment of its advertising pages to convey their merchandising messages to America's rich and fertile electroplating and metal finishing market. And as a material expression of PLATING MAGAZINE's esteem for the long-time patronage of these many advertisers, its Managing Editor wrote a personal letter of appreciation to each. PLATING also demonstrated that appreciation by proudly listing those fine industrial companies both in the GOLDEN JUBILEE ISSUE of the magazine's "Market Data and Media File," and on a large panel prominently to be displayed in PLATING's section of the AES's FIFTIETH ANNIVERSARY LOUNGE at AES's Fifth Industrial Finishing Exposition.

5. RESEARCH IN THE JUBILEE:

AES Research, too, has played a prominent part in AES's GOLDEN JUBILEE. Not only has it provided an effective Research Section portraying the past and present of AES Research that featured the April 1959 issue of PLATING MAGAZINE but, like PLATING, has manifested its appreciation to the many American and Canadian companies that, as Sustaining Members, are providing an appreciable share of its financial sustenance, by listing those Sustaining Members on a mural arrestingly to be exhibited in the Research Section of the AES's FIFTIETH ANNIVERSARY LOUNGE at the Industrial Finishing Exposition.

6. "AES MEMBERSHIP: ITS MEANING"

Among many other benefits stemming to AES from the GOLDEN JUBILEE—including a widespread sense and pride of "belonging" engendered in AES members—has been the realization fostered in many non-member individuals involved in electroplating and metal finishing that self-improvement lies in educational enrichment, and that AES affords fertile means for both. To cultivate the resultant flow of inquiries, National Headquarters published its well-received booklet, "AES Membership: Its Meaning to YOU." The booklet has also served AES Branches helpfully in the common effort to increase their membership rosters by at least a dozen acceptable additional members per-Branch during the GOLDEN JUBILEE, over and beyond those elected during the period from July 1-December 31, 1958. And larger membership naturally means larger opportunity for educational benefits to all AES members.

7. GOLDEN JUBILEE: ITS CLIMAX:

With the year-long FIFTIETH ANNIVERSARY focussed and time-tabled to a specific sweeping climax, that program's apex will, of course, be AES's Golden Jubilee Convention, Industrial Finishing Exposition and International Conference on Electrodeposition and Metal Finishing that will be held in Detroit, June 15-19, 1959.

At this writing, that three-point event is expected to draw the largest assembly of AES members, their families and guests, from near and far off places, in AES's five-decade history. Aside from the Statler-Hilton and the Sheraton-Cadillac, headquarters hotels, six other of Detroit's name hostelries are booked to accommodate AES's expected large attendance. Anniversary atmosphere and spirit will abound and there will be appropriate GOLDEN JUBILEE pageantry and circumstance. There will be a large scale, memorable Ladies Program—abundant industrial plant tours—king-size relaxational fare—many gifts and prizes.

As the Fifth International Conference on Electrodeposition and Metal Finishing, the GOLDEN JUBILEE CONVENTION's educational sessions will number eleven. Experts from ten countries, including the United States, England, Canada, Australia, France, Switzerland, Germany, Holland, India and Italy, will present 44 technical and scientific papers enriching knowledge in electroplating, metal finishing and allied arts. Three sessions alone will cover organic finishing. The Opening Session will feature the first "William Blum Lecture," and it will be delivered by renowned Dr. William Blum himself, first winner of AES's Scientific Achievement Award, the Society's highest scientific honor.

The Industrial Finishing Exposition, largest of its kind in AES history, will feature some 36,000 square feet of exhibition space, and this area will mainly be employed by the largest number of companies to display their latest equipment and processes vital to electroplaters and metal finishers in AES's lifetime.

There will be other features—the announcement, for example, of the second winner of AES's Scientific

Charles B. Niebling
Member of the prominent law firm of Lum, Fairlie and Foster of Newark, N. J., General Counsel of the AES.

Clyde A. Zukswert
Head of Clyde A. Zukswert & Co., Newark's noted certified public accounting company, and AES's long-time Auditor.

Bob Wettstein
Head of Bob Wettstein & Associates, PLATING MAGAZINE's award-winning Western Advertising Representative.

Achievement Award— the bestowing of AES Paper Awards—the naming of AES Honorary Members and Award of Merit winners—the election and installation of AES's new officers—the Annual Meeting of AES's governing council—finally the gala Farewell Banquet and the stepping off of AES into its Fifty-First Year of service to electroplating, metal finishing and allied arts and hence to the public interest.

8. FIFTIETH ANNIVERSARY LOUNGE:

Apart from the displays at the AES's Industrial Finishing Exposition, audience will also view the history and current status of electroplating and metal finishing through exhibits created cooperatively by PLATING MAGAZINE, "Metal Finishing Magazine" and "Products Finishing Magazine."

These exhibit areas, each a distinct entity of its own, will be lounges for rest and relaxation by the Exposition's heavy and busy traffic. Sited at a considerable distance from one another, each will portray a different but coordinated phase of the growth and progress of plating and metal finishing through diverse visual aids.

The PLATING MAGAZINE phase, for example, will be an element of the FIFTIETH ANNIVERSARY LOUNGE of the AES itself. Here relaxing crowds will visually see unfurled before them, the dramatic biography of the AES from scratch in 1909 to date—plus not only the visual story of PLATING MAGAZINE but also of AES's Research Program. From the trained staff manning the Lounge, audience, moreover, will be able to receive desired fuller information orally and via pinpointed printed matter.

9. GREETINGS THAT AES CHERISHES:

During its FIFTIETH ANNIVERSARY, AES has been greeted by resolution and letter, and saluted by proclamation, abundantly. It appreciates indeed each and every one of the gracious expressions received from its friends and well-wishers internationally. These have included greetings, among many others, from:

A. The Governor of New York and Mayor of New York City—the State and municipality of AES's nativity.
B. The Governor, the Senior Senator and the respective Congressmen of New Jersey, the State of AES's present incorporation—and from the Mayor of Newark, seat of AES's National Headquarters.
C. The Mayor of Philadelphia in whose Commonwealth, AES lived from 1946 to 1952.
D. The Mayor of Detroit and the Governor of Michigan, site of AES's GOLDEN JUBILEE CONVENTION—and from the President, too, of Detroit's Chamber of Commerce.
E. The head of the National Bureau of Standards.
F. The President of the Chamber of Commerce of the United States.
G. The Presidents of numerous scientific, technical and trade associations and societies closely related to AES, including the American Society of Testing Materials—the American Society of Metals—the Electrochemical Society—the Metal Finishing Suppliers' Association—the National Association of Metal Finishers—the American Society of Association Executives—the Institute of Metals headquartered in London, England—many others.
H. The Publisher of "Metal Finishing," the Editor of "Products Finishing" and the Editor of "Plating Management."
I. The Minister of Trade & Commerce of Canada.
J. The American Ambassador to the Court of St. James.
K. The Ambassador of Her Brittanic Majesty to the United States.
L. The President of the United States who has graciously expressed intention to send his greetings to AES's GOLDEN JUBILEE Convention.

10. "AES GOLDEN JUBILEE WEEK IN DETROIT":

And one of the most dramatic and appreciated manifestations of good will and confidence received by AES stemmed from the great municipality of Detroit whose Mayor has proclaimed June 15-19, 1959, week of AES's GOLDEN JUBILEE Convention and Exposition, as "AES GOLDEN JUBILEE WEEK IN DETROIT" thus:

Mrs. Florence K. Marquardt

AES's Convention Reporter. Her record, 22 consecutive Annual Conventions and 5 of 6 Interim Meetings of the Supreme Society.

> WHEREAS The American Electroplaters' Society (AES), an educational Society currently composed of members residing globally, the bulk of whom are respectively grouped into 50 chartered Branches in the United States, 5 in Canada and 3 in Australia, is observing its FIFTIETH ANNIVERSARY, and
>
> WHEREAS AES has for five full decades dedicated itself to the enrichment of knowledge and advancements in electroplating, metal finishing and allied arts, and its educational activities have included a broad research program involving projects conducted at a number of American and Canadian universities and foundations that have fostered and benefitted the public interest, and
>
> WHEREAS AES members are scattered throughout our country's automotive, aircraft, electrical and other industries engaged in metal finishing and, therefore, every individual of our nation comes into contact every day with the myriad of products that have been developed or produced by them, ranging from missiles, aircraft and automobiles to fountain pens, safety pins and other common household products, and
>
> WHEREAS The Society will climax its Golden Jubilee by a large-scale Golden Jubilee Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing that will be held in Detroit, June 15-19, 1959, and that will draw to our municipality, the leadership and rank and file of that industry from all over the world:
>
> THEREFORE I, Louis C. Miriani, Mayor of Detroit, do hereby proclaim the week of June 15-19, 1959, as AMERICAN ELECTROPLATERS' SOCIETY GOLDEN JUBILEE WEEK in Detroit, and I urge all the citizens of our community to honor and salute this time-tested enterprise that, nationally, is currently observing its Golden Jubilee of public service.

IN CONCLUSION

Any and all AES progress is naturally the collaborative handiwork of many AES elements, including the Supreme Society; the Executive Board; Branches and Branch leadership; Standing and Special Committees; PLATING and Convention paper authors; members, individually and collectively, here and abroad—plus, of course, the dedicated staff at Headquarters that has demonstrated itself notably by the quality and quantity of its output.

To all the aforementioned, AES congratulations are in order for an outstanding GOLDEN JUBILEE year. And to staff, the same congratulations—but with a very special and proud "thank you."

RESEARCH CHAIRMAN'S REPORT

by

Dr. Russel E. Harr

IN CELEBRATING its FIFTIETH ANNIVERSARY, the American Electroplaters' Society can also take pride in the accomplishments of its venerable Research Program. The diligent cooperation of all associated with the Program has resulted in continued good progress.

GENERAL

Seven projects continue to be active. Since one appears to be nearing its concluding phase, new projects are being reviewed. These include organic coatings as well as electrodeposited finishes. Curtailment of business activity during the past year and a consequent reduction in the number of Sustaining Members has precluded the initiation of a new project this year.

Table I contains a summary of information on current projects. Quarterly Reports of progress are sent to all Sustaining Members. In addition, the April issue of PLATING is substantially devoted to a summary of the year's activity on Research Projects.

PUBLICATION

Serial Report No. 39, a bibliography on Mechanical Finishing of Metal Surfaces, was published and two Research Program papers appeared in "Technical Proceedings" (1958 edition).

PRESENT STATUS OF RESEARCH PROJECTS

PROJECT 12—Cleaning and Preparation of Metals for Electroplating.

Oil Spreading Studies—

Refinements in the equipment used to evaluate spreading rates of organic soils have been made which will eliminate airborne contamination. The results this investigation are expected to provide more information on the relationships existing between various mixtures of spreading and non-spreading types of organic soils.

Adhesion of Electrodeposits—

Study of the effect of organic soils on the adhesion of nickel deposits on a copper basis metal is being continued. In this portion of the investigation, the effect on the adhesion of nickel deposits by the type of soil, temperature of application, and temperature and time of storing soiled specimens will be determined.

PROJECT 13—The Nature, Cause and Effect of Porosity in Electrodeposits.

Work is continuing in the area of correlating the initial porosity of nickel coatings with the subsequent actual development of corrosion products at the sites of observed porosity.

In addition. the galvanic effects of the nickel-chromium couple are being investigated. The effects include the relative areas of electrodes, pH and type of electrolyte.

PROJECT 14—The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating.

Further data using the Corrodkote Test have been obtained on the performance of Watts nickel deposits plated on basis metals which have been stretched and then polished or chemically treated. A paper covering the recent work of this project will be presented at the Detroit Convention in June 1959.

PROJECT 15—Accelerated Corrosion Tests

The Corrodkote Test and the Copper Chloride Accelerated Acetic Acid Salt Spray Test are continuing to receive the complete attention of the Project Committee. The procedures for carrying out these two test methods remain substantially unchanged from those which were published in PLATING, July, 1957. The tests are receiving at least tentative approval in industry and are proving valuable for product acceptance and for evaluating electroplating research. Some evidence has been accumulated indicating the usefulness of the tests in evaluating coatings other than copper, nickel, and chromium.

Dr. Russel E. Harr

Committee work is continuing to be involved in the complete standardization of the procedures, together with their adaptability to coatings other than those originally studied.

PROJECT 16—Mechanism of Electrodeposition.

The Research issue (April, 1959) of PLATING carried a feature article covering recent work of the Project.

An investigation of over potential phenomena when plating on gallium, above and below its melting point, indicates the desirability of future work to determine how deposition is affected by crystallographic orientation.

PROJECT 17—Microthrowing Power.

Recent progress of this project will be summarized in a paper to be presented at the June 1959 Convention, in Detroit, Michigan. This paper will include data on the effect of the concentration of metal ions, anions, temperature, and current density as they influence the amount of deposit in small crevices.

PROJECT 18—Mechanical Finishing of Metal Surfaces.

The optimum conditions for carrying on the buffing operation on zinc base die castings have been established at 5,000 surface feet per minute as the wheel speed, 15 feet per minute traveling under the wheel, at a pressure of 25 lb. on seven sections of buff. However, it has been established that the most critical variable is the amount and method of applying the buffing compound. It seems that the steadier or oftener the buffing compound can be applied, the more efficient the operation. To better investigate the variable, an automatic applicator has been installed and work has started on this phase. A report on this project is being written and should be available for publication soon.

CURRENT AND FUTURE PLANS

Expenditures may moderately exceed income this year. Prospects, however, are becoming brighter for reversal of the recent economic recession during the coming year. No new projects have been started, but the Subcommittee on New Projects has a number under consideration, including one involving organic finishes.

IN CONCLUSION

On the strength of the cooperation of members of the Research Committee and those associated with the various projects, good progress can be reported. In addition to the regular duties, good progress was made in providing improved contractual relations with the various projects. Also special committee activities were necessary to obtain information on new projects and to provide a suitable Research Program exhibit with AES's FIFTIETH ANNIVERSARY LOUNGE at the GOLDEN JUBILEE CONVENTION and Industrial Finishing Exposition.

In closing, the Chairman and the entire Committee wishes to express its appreciation for the splendid work of District Supervisors, Project Committee members, Directors and Fellows. We also wish to thank the Sustaining Members for their continued support of this unique cooperative research program.

SUMMARY OF AMERICAN ELECTROPLATERS' SOCIETY RESEARCH PROJECTS 1958-1959

Project	Location	Project Director	Committee Chairman	Fellow	Subject	Status
12	Columbia University	Dr. H. B. Linford	E. T. Candee	J. Desmond Wm. P. Brown J. Grunwald	Cleaning—Oxide Effects	Active
13	Bureau of Standards	Fielding Ogburn	C. H. Sample	Dr. D. Ernst W. H. Roberts	Nature, Cause, and Effect of Porosity in Electrodeposits	Active
14	Ontario Research Foundation	Dr. M. H. Jones	W. M. Tucker	J. Zajdowski	Effect of Basis Metal Conditions on Plating	Active
15	Detroit Area	None	W. L. Pinner	None needed	Accelerated Corrosion Tests	Active
16	University of Pennsylvania	Dr. J. O'M. Bockris	E. Bowerman	Mr. Enyo	Mechanism of Electrodeposition	Active
17	Virginia Institute for Scientific Research	Dr. H. Leidheiser Jr.	A. H. DuRose	Lucille B. Garmon	Microthrowing Power	Active
18	Chicago Area	W. C. Geissman	R. S. Modjeska	G. Nausner K. Gatchel	Mechanical Finishing of Metal Surfaces	Active

BRANCH DELEGATES COMPOSING THE SUPREME SOCIETY

The AES's highest governing Council, known as "Supreme Society" is composed of three duly elected Delegates from each of the 58 chartered AES Branches. Accredited by the Credentials Committee, these Delegates, as a body, were the governors and lawmakers of this Society in its GOLDEN ANNIVERSARY year (1958-1959).

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JOHN P. NICHOLS, *Chairman (and all Branch Secretaries)*

EXHIBIT AWARDS COMMITTEE

CHESTER G. BORLET, Grand Rapids Brass Co., *Chairman*
ANDREW CATCHMARK, Chrysler Corporation
WILLIAM H. TRUSDELL, Platers & Coaters, Inc.

LAW COMMITTEE

MANSON GLOVER, Glover Coating Co., *Chairman*
MYRON B. DIGGIN, Hanson-Van Winkle-Munning Co.
WILLIAM J. NEILL, Columbus Metal Products, Inc.

MEMBERSHIP COMMITTEE

MANUEL BEN, General Motors Corp., *Chairman*
ROBERT L. GARRETT, TWA Overhaul Base, Mid-Continent Airport, *Secretary*
GEORGE E. BEST, Allied Chemical Corp.
JOHN J. BUNSIC, General Electric Co.
JAMES E. COGAN, JR., Globe Electric Plating Co.
LOUIS V. GAGNON, Enthone, Inc.
G. STUART KRENTL, Allied Cleaning Compounds Co.
M. LESTER REYNOLDS, Wm. Lynn Chemical Co.
GEORGE W. TAYLOR, Production Plating Co.
DR. W. ANDREW WESLEY, International Nickel Co.
BRUCE A. LESLIE, Victoria, Australia (Consultant)
STANLEY A. FROST, Canadian Hanson-Van Winkle Co., Ltd. (Consultant).

PAPER AWARDS COMMITTEE

FRANK O. BEUCKMAN, Eastman Kodak Co., *Chairman*
R. SCOTT MODJESKA, Scientific Control Laboratories
OTTO BERT KIRCHOFF, Jamestown Electroplating Company

PUBLICATIONS COMMITTEE

DR. SAMUEL HEIMAN, Philadelphia Rust Proof Co., *Chairman*
DR. D. GARDNER FOULKE, Hanson-Van Winkle-Munning Co.
DR. VERNON A. LAMB, U. S. Department of Commerce
DR. HENRY LEIDHEISER JR., Virginia Institute for Scientific Research
R. SCOTT MODJESKA, Scientific Control Laboratories
DR. RICHARD B. SALTONSTALL, Udylite Corporation
DR. EARL J. SERFASS, Lehigh University
DR. JOSEPH V. PETROCELLI, International Nickel Co.
DR. HAROLD J. WIESNER, Bendix Aviation Co.

PUBLIC RELATIONS COMMITTEE

FRANK TIRENDI, Patent Button Co., *Chairman*
ROBERT M. NORTON, Hanson-Van Winkle-Munning Co., *Vice Chairman*
JOHN P. NICHOLS, American Electroplaters' Society, *Secretary-Treasurer*
MANSON GLOVER, Glover Coating Co.
I. WILLIAM MARCOVITCH, American Machine & Metals, Inc.
H. J. MCCRACKEN, Northwest Chemical Company
ARTHUR G. PIERDON, Art Metal Finishing Co.
MORGAN D. RAKE, International Business Machines Co.
HERMAN A. TESSMAN, Allen-Bradley Company
ROBERT C. TREES, Udylite Corporation

RESEARCH COMMITTEE

DR. RUSSEL E. HARR, Western Electric Co., *Chairman*
JAMES D. THOMAS, General Motors Corp., *Vice Chairman (Research)*
KERGAN WELLS, W. W. Wells, Ltd., *Vice-Chairman (Finance)*
JOHN P. NICHOLS, American Electroplaters' Society, *Secretary-Treasurer*
DR. WILLIAM BLUM, *Consultant*
GLADE B. BOWMAN, Rockwell-Standard Corp.
LESLIE L. DIVELEY, Cutler-Hammer Co.
DR. D. GARDNER FOULKE, Hanson-Van Winkle-Munning Co.
RAYMOND L. MITCHELL, Mitchell-Bate Co.
WALTER E. MOLINE, National Cash Register Co.
LELAND M. MORSE, Chrysler Corporation
CLARENCE H. SAMPLE, International Nickel Co. (*ASTM Liaison Representative*)

SCIENTIFIC ACHIEVEMENT AWARD COMMITTEE

DR. ABNER BRENNER, National Bureau of Standards, *chairman*
MYRON B. DIGGIN, Hanson-Van Winkle-Munning Co.
DR. RUSSEL E. HARR, Western Electric Co.
DR. SAMUEL HEIMAN, Philadelphia Rust Proof Company, Inc.
DR. EDWARD A. PARKER, Technic, Inc.
DR. LOUIS WEISBERG, Consultant

SPECIAL AES COMMITTEES

APPRAISAL COMMITTEE AS TO NEED FOR A CONVENTION PLANNING COMMITTEE

WRIGHT W. WILSON, Chrysler Corp., *Chairman*
G. ROSS DAVIDSON, Canadian Hanson-Van Winkle Co.
DR. SAMUEL HEIMAN, Philadelphia Rust Proof Co.
ARTHUR G. PIERDON, Art Metal Finishing Co.
GEORGE SCHORE, Brucar Equipment & Supply Co.
CHARLES WISE, Buckeye Products Co.

APPRAISAL COMMITTEE AS TO NEED FOR AND DUTIES OF A PLANNING COMMITTEE

ELLSWORTH T. CANDEE, Lea Manufacturing Co., *Chairman*
EZRA A. BLOUNT, "Products Finishing."
CLEVELAND F. NIXON, General Motors Corp.
FIELDING OGBURN, National Bureau of Standards.
DR. RALPH A. SCHAEFER, The Bunting Brass & Bronze Co.

HONORARY MEMBERSHIP AWARDS COMMITTEE

KENNETH M. HUSTON, Armco Steel Corp., *Chairman*
CHARLES C. CONLEY, Clevite Graphic Bronze Co.
LESLIE L. DIVELEY, Cutler-Hammer Co
LOUIS V. GAGNON, Enthone, Inc.

LIAISON WITH OTHER SOCIETIES

1. American Society for Testing Materials (ASTM)
   JOHN P. NICHOLS, American Electroplaters' Society

   ASTM COMMITTEE A-5, Corrosion of Iron and Steel
   AUGUST MENDIZZA, Bell Telephone Laboratories

   ASTM Committee B-8, Electrodeposited Metallic Coatings
   DONALD M. BIGGE, Chrysler Corporation

   ASTM Committee D-19, Industrial Water
   GEORGE E. BEST, Allied Chemical Corp.

   ASTM Committee B-7, Sub-Committee VI on the Anodic Oxidation of Aluminum and Magnesium Alloys
   R. F. HAFER, Reynolds Metals Company

2. American Standards Association (ASA) Committee Z-74 Performance of Effluent Air and Gas Cleaning Equipment
   GEORGE SCHORE, Brucar Equipment & Supply Co.

   ASA Committee Z-9, Sectional Committee on Safety Codes for Exhaust Systems
   W. R. FIDELIUS, Hanson-Van Winkle-Munning Co.

3. International Council for Electrodeposition & Metal Finishing
   DR. WALTER R. MEYER, Enthone, Inc.
   WALTER L. PINNER, The McGean Chemical Co.

4. Inter-Society Corrosion Committee
   GEORGE E. BEST, Allied Chemical Corp.

5. Metal Finishing Suppliers Association
   R. F. LEDFORD, Chemray Corporation

6. National Association of Corrosion Engineers
   GEORGE E. BEST, Allied Chemical Corp.

7. National Association of Metal Finishers
   ARTHUR G. PIERDON, Art Metal Finishing Co.

8. National Technical Task Committee on Industrial Wastes
   DR. D. GARDNER FOULKE, Hanson-Van Winkle-Munning Co.

9. Ohio River Valley Sanitation Commission
   WILLIAM J. NEILL, Columbus Metal Products, Inc.

10. Society for Plastic Engineers
    ARTHUR W. LOGOZZO, Nutmeg Chrome Co.

BRANCH DIRECTORY*

(GOLDEN JUBILEE YEAR 1958-1959)

ADELAIDE

Secretary-Treasurer: R. J. Down
13 Sedgeford Rd., Myrtle Bank, South Australia
Meeting Place: 17 Waymouth St., Adelaide
Day of Month: Various
Time: 6:00 P. M.
Sustaining Members:
None

ALLENTOWN-READING

Secretary-Treasurer: Homer Ressler
1109 W. Union Blvd., Bethlehem, Pa.
Meeting Place: Scotty's Anchorage, Emmaus, Pa.
Day of Month: Fourth Thursday
Time: Dinner 7:30 P.M.
Sustaining Members:
Bethlehem Steel Co. (2), Bethlehem, Pa.
L. F. Grammes & Sons, Inc., Allentown, Pa.
The New Jersey Zinc Co. (of Pennsylvania), Palmerton, Pa.

BALTIMORE-WASHINGTON

Secretary: Harold W. Scott
448 Munson Hill Road, Falls Church, Virginia
Meeting Place: Chemistry Bldg., National Bureau of Standards, Washington 25, D. C.
and
Stafford Hotel, Baltimore, Md.
Day of Month: Second Tuesday
Time: 8:00 P.M.
Sustaining Members:
Allied Research Products, Inc., Baltimore 5, Md.
American Instrument Co., Silver Spring, Md.
Atlas Powder Co., Wilmington 99, Del.
E. I. duPont de Nemours & Co., Inc., Wilmington 98, Del.

BLUE RIDGE

Secretary-Treasurer: Carl A. Witherspoon
Box 286, Blacksburg, Virginia
Meeting Place: Roanoke, Blacksburg, Winston-Salem, Lynchburg.
Day of Month: First Friday
Time: 6:30 P.M.

BOSTON

Secretary-Treasurer: Dr. George P. Swift
53 Galen St., Watertown 72, Mass.
Meeting Place: Hotel Statler, Boston, Mass.
Day of Month: First Thursday
Time: Dinner 6:00 P.M.—Meeting—8:00 P.M.
Sustaining Members:
American Anodizing Corp., Quincy, Mass.
M. E. Baker Co., Cambridge, Mass.
Beacon Supply Co., Chelsea, Mass.
F. L. & J. C. Codman Co., Rockland, Mass.
United-Carr Fastener Corp., Cambridge 42, Mass.

BRIDGEPORT

Secretary-Treasurer: Robert G. Parker
25 Beverly Rd., Trumbull 58, Conn.
Meeting Place: Hotel Barnum, Bridgeport, Conn.
Day of Month: Second Friday
Time: 8:00 P.M.
Sustaining Members:
Electrolux Corp., Old Greenwich, Conn.
Mitchell-Bradford Chemical Co., Bridgeport, Conn.
Roberts Rouge Co., Stratford, Conn.
E. E. Seeley Co. Inc., Bridgeport, Conn.
Yankee Metal Products Corp., Norwalk, Conn.

BRITISH COLUMBIA

Secretary: Nelson Sheppard
No. 4, 2720 Lonsdale Ave. No. Vancouver, B. C.
Meeting Place: White Spot Barbecue, 25 & Cambie St.
Vancouver, B. C.
Day of Month: Mid-Month
Time: 6:00 P.M.

* Numbers after names of Sustaining Members indicate number of memberships supported. This Directory is as at April 1, 1959.

BUFFALO

Secretary: Robert E. Lienert
44 Fancher Ave., Buffalo 23, N. Y.
Meeting Place: Niagara Manor, 899 Niagara Falls Blvd., Buffalo, N. Y.
Day of Month: 1st Friday
Time: 6:30 P.M. Dinner—Meeting 8:00 P.M.
Sustaining Members:
Van Der Horst Corporation of America, Olean, N. Y.

CAPITOL DISTRICT

Secretary: William R. Allison
237 Gifford Road, Schenectady, N. Y.
Meeting Place: Hot Shoppe, Albany, N.Y.
Day of Month: First Monday
Time: 7:00 P.M.
Sustaining Members: None

CENTRAL MICHIGAN

Secretary-Treasurer: R. W. Boos
2400 E. Mt. Hope, Okemus, Michigan
Meeting Place: Roosevelt Hotel, Lansing, Mich.
and
Hayes Hotel, Jackson, Mich.
Day of Month: First Tuesday
Time: 7:00 P.M. (Dinner Meeting)
Sustaining Members:
None

CHICAGO

Secretary-Treasurer: Paul Glab
882 N. Paulina St., Chicago 22, Ill.
Meeting Place: The Western Society of Engineers, 84 E. Randolph St., Chicago, Ill.
Day of Month: First Friday
Time: Dinner 6:15—Meeting 7:15

Sustaining Members:
Acid Products Co., Inc., Chicago, Ill.
Allied Industrial Products, Inc., Chicago, Ill.
American Buff Co., Chicago 16, Ill.
American Cabinet Hardware Corp., Rockford, Ill
American Can Co., Maywood, Ill.
American Nickeloid Co., Peru, Ill.
Amphenol Electronics Corp., Chicago 50, Ill.
Apex Plating Co., Chicago 7, Ill.
Apollo Metal Works, Chicago 38, Ill.
Ardco, Inc., Chicago 38, Ill.
Arrow Plating Co., Inc., Chicago 47, Ill.
Atlas Plating Works, Cicero 50, Ill.
Bastian Blessing Co., Chicago 30, Ill.
Belke Mfg. Co., Chicago, Ill.
Bell & Howell Co., Chicago 45, Ill.
Berteau-Lowell Plating Works, Chicago 47, Ill.
G. S. Blakeslee & Co., Cicero, Ill.
Chicago Electroplaters' Institute, Chicago 1, Ill.
Chicago Roller Skate Co., Chicago 24, Ill.
The Clinton Co., Chicago, Ill.
The C. P. Hall Co. of Illinois
The Crane Co., Chicago 5, Ill.
Croname, Inc., Chicago 13, Ill.
Crown Rheostat & Supply Co., Elk Grove Village, Ill.
The Diversey Corp., Chicago 13, Ill.
R. R. Donnelly & Sons Co., Chicago, Ill.
Duro Chrome of Chicago, Inc., Chicago 12, Ill.
Elco Products Co., Chicago 39, Ill.
Electro-Glo Co., Chicago, Ill.
Felt & Tarrant Mfg. Co., Chicago 22, Ill.
General American Trans. Corp., Kanigen Div., Chicago 90, Ill.
Graham Plating Works, Chicago, Ill.
Hardwood Line Mfg. Co., Chicago 47, Ill
Industrial Filter & Pump Mfg. Co., Chicago 50, Ill.
Kamide Div., Kraft Chemical Co., Chicago 8, Ill.
Kelite Products, Inc., Los Angeles, Calif.
Kocour Co., Chicago 32, Ill.
R. Lavin & Sons, Inc., Chicago 23, Ill.
Charles F. L'Hommedieu & Sons, Inc., Chicago 23 Ill.
M-W Laboratories, Inc., Chicago 47, Ill.
The Matchless Metal Polish Co., Chicago, Ill.
The Meaker Co., Chicago 50, Ill.
Mechanical Plating Co., Chicago 22, Ill
Mercil Plating Equipment Co., Chicago , Ill.
B. Mercil & Sons Plating Co., Chicago 12, Ill.
Metalcraft Corp., Chicago 10, Ill.
Metalwash Corp., Barrington, Ill.
The Modern Plating Co., Chicago 18, Ill.
Modern Plating Corp., Freeport, Ill.

G. J. Nikoles & Co., Inc., Bellwood, Ill.
Northwestern Plating Works, Chicago 23, Ill.
Platers Technical Service, Inc., Chicago 5, Ill.
Plating Service Co., Chicago 39, Ill.
Precision Electroplating Co., Chicago, Ill.
Poor & Company, Promat Division, Waukegan, Ill.
Reliable Plating Corp., Chicago 7, Ill.
Reliable Plating Rack Co., Schiller Park, Ill.
Scientific Control Laboratories, Chicgo 23, Ill.
Sparkler Mfg. Co., Mundelein, Ill.
Standard Plating Rack Company, Chicago 22, Ill.
George A. Stutz Mfg. Co., Chicago, Ill.
Sunbeam Corp., Chicago 50, Ill.
Technic, Inc., Chicago 26, Ill.
Ther Electric & Machine Works, Chicago, Ill.
Time Chemical, Inc., Chicago 9, Ill.
United Manufacturing Co., Chicago 18, Ill.
Van Straaten Chemical Co., Chicago, Ill.
Western Electric Co., Inc., Chicago 23, Ill.
Western Rust-Proof Co., Chicago, Ill.

CINCINNATI

Secretary: David L. Kaplan
817 Sabino Court, Cincinnati 31, Ohio
Meeting Place: Engineering Society Headquarters, Cincinnati
Day of Month: Fourth Wednesday
Time: Dinner 6:30 P.M.—Meeting 7:30 P.M.

Sustaining Members:
Products Finishing, Cincinnati, Ohio

CLEVELAND

Secretary-Treasurer: James K. Long
1945 E. 97th St., Cleveland 6, Ohio
Meeting Place: Cleveland Engineering Societies' Building
Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:
Acme Plating Co., Cleveland, Ohio
Advance Plating Co., Cleveland, Ohio
Cowles Chemical Co., Cleveland, Ohio
Diamond Alkali Co., Chromium Chemicals Division, Cleveland 14, Ohio
Eaton Manufacturing Co., Cleveland 10, Ohio
Harshaw Chemical Co. (2), Cleveland, Ohio
R. O. Hull & Co., Inc., Rocky River 16, Ohio
Incor, Inc., Cleveland 14, Ohio
The Kelly Plating Company, Cleveland, Ohio
Lorence Plating Co., Cleveland 4, Ohio
The McGean Chemical Co., Cleveland 9, Ohio
Pittsburgh Steel Co., Thomas Strip Div., Warren 14, Ohio
Platers Supply Co., Cleveland 14, Ohio
Republic Steel Corp., Cleveland, Ohio
Rockwell Spring & Axle Co., Newton Falls, Ohio
Talon, Inc., Meadville, Pa.
True Temper Corporation

COLUMBUS

Secretary: Leslie D. McGraw
3308 Sciotangy, Columbus, Ohio
Meeting Place: Battelle Memorial Institute, Columbus, Ohio
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
None

DALLAS-FORT WORTH

Secretary-Treasurer: A. C. Fricke
212 Julian St., Dallas 3, Texas
Meeting Place: Lennox Hotel, Grand Prairie, Texas
Day of Month: Third Wednesday
Time: 6:30 P.M.—Dinner—8:00 P.M.—Meeting
Sustaining Members:
Lane Plating Works, Dallas, Texas

DAYTON

Secretary: Richard M. Clinehens
3206 Harwood St., Dayton 20, Ohio
Meeting Place: Hotel Dayton-Biltmore, Dayton, Ohio
Day of Month: Third Wednesday
Time: 8:00 P.M.

Sustaining Members:
Dayton Rust Proof Co., Dayton, Ohio
National Cash Register Co., Dayton, Ohio
Rack Processing Co., Dayton 9, Ohio
Rawec Plating Co., Springfield, Ohio

DETROIT

Secretary-Treasurer: Edward J. Kubis
Wyandotte Chemicals Corp., Wyandotte, Mich.
Meeting Place: Hotel Statler, Detroit, Mich.
Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:
Auto City Plating Co., Detroit 17, Mich.
Bruce Products Corp., Howell, Mich.
Buckingham Products Co., Detroit 27, Mich.
Chrysler Corp. (2), Detroit, Mich.
Congress Die Casting Co., Detroit 34, Mich.
Ford Motor Co. (5), Dearborn, Mich.
Formax Manufacturing Co., Detroit, Mich.
General Motors Corporation, Research Staff (5), Detroit 2, Mich.
Grand Steel & Mfg. Co., Clawson, Mich.
Harshaw Chemical Co., Detroit, Mich.
Higgins Rack Coating & Mfg. Co., Hazel Park, Mich.
Hoover Ball & Bearing Co., Adrian, Mich.
Houdaille Industries, Inc. (2), Detroit, Mich.
Howard Plating Industries, Inc., Royal Oak, Mich.
Knight Plating Co., Detroit 7, Mich.
Lyon, Inc., Detroit 28, Mich.
Metal Mouldings Corp., Detroit 28, Mich.
Metal Plating Corp., Oak Park, Mich.
Metal & Thermit Corp., New York, N. Y.
Midwest Chrome Process Co., Detroit 9, Mich.
George L. Nankervis Co., Detroit 27, Mich.
Nelson Chemicals Co., Detroit 27, Mich.
Northwest Chemical Co., Detroit 4, Mich.
Oakman Manufacturing Co., Van Dyke, Mich.
Plating Inst. of Michigan, Lincoln Park, Mich.
Reed Plating Company, Detroit 11, Mich.
Reilly Plating Company, Melvindale, Mich.
J. J. Siefen Co., Detroit 9, Mich.
Siefen Compounds, Inc., Detroit 38, Mich.
Solventol Chemical Products, Inc., Detroit 3, Mich.
Frederic B. Stevens, Inc. (2), Detroit 16, Mich.
Superior Polishing Company, Van Dyke, Mich.
The Udylite Corp. (3), Detroit 11, Mich.
United Platers, Inc., Detroit, Mich.
Univertical Foundry & Machine Co., Detroit, Mich.
A. T. Wagner Co., Detroit, Mich.
Wagner Brothers, Inc., Detroit 3, Mich.
Whitfield Chemical Co., Detroit, Mich.
Wyandotte Chemicals Corp., Wyandotte, Mich.

GRAND RAPIDS

Secretary: C. J. Byrns Jr.
1231 Fay Road, N.W., Grand Rapids, Mich.
Meeting Place: Scotties Restaurant-"Trader Room"
Day of Month: Second Friday
Time: 7:00 P.M.

Sustaining Members:
Dexter Industries, Inc., Grand Rapids 2, Mich.
Doehler-Jarvis Corp., Grand Rapids, Mich.
Expert Coating Co., Grand Rapids, Mich.
P. B. Gas & Company, Grand Rapids, Mich.
Grand Rapids Plating Co., Inc., Grand Rapids 5, Mich.
Grand Rapids Brass Co., Grand Rapids, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hanson-Van Winkle-Munning Co., J. C. Miller Div., Grand Rapids, Mich.
Haviland Products Co., Grand Rapids, Mich.
Keeler Brass Co., Grand Rapids, Mich.
Knape & Vogt Mfg. Co., Grand Rapids, Mich.
Precision Castings Company of Michigan, Kalamazoo, Mich.
Preston Products Co., Grand Rapids 4, Mich.
Roto-Finish Company, Kalamazoo, Mich.

HAMILTON

Secretary: C. Ross MacLeod
40 W. 3rd St., Hamilton, Ontario, Canada
Meeting Place: Scotties Restaurant-"Trader Room"
Day of Month: Third Friday
Time: 8:15 P.M.

Sustaining Members:
Behr-Manning, Ltd., Brantford, Canada
Westinghouse Corporation of Canada, Ltd., Hamilton, Ontario, Canada

HARTFORD

Secretary: Stanley Platoz
26 Erwin Place, New Britain, Conn.

Meeting Place: Hotel Bond, Hartford, Conn.

Day of Month: Third Monday
Time: 7:45 P.M.

Sustaining Members:
Arrow Hart & Hegeman Electric Company, Hartford 6, Conn.
W. D. MacDermid Chemical Co., Bristol, Conn.
Royal Typewriter Company, Hartford, Conn.

HOUSTON

Secretary-Treasurer: N. C. Van Wagner
Box 4008, Houston 2, Tex.

Meeting Place: Sonny Looks Cafe

Day of Month: Third Tuesday
Time: 6:30 P.M.

Sustaining Member:
Dixie Electro Plating Company, Houston 3, Texas

INDIANAPOLIS

Secretary: Addison Howard
169 N. Indiana, Mooresville, Indiana

Meeting Place: Fox's Steak House, 1207 E. Washington St., Indianapolis, Ind.

Day of Month: First Monday
Time: Dinner 6:30—Meeting 8:00 P.M.

Sustaining Members:
Arvin Industries, Inc., Columbus, Ind.

KANSAS CITY

Secretary: Robert L. Garrett
3828 E. 9th Ter., Kansas City 27, Mo.

Meeting Place: Regan's Restaurant, 207 Southwest Blvd.

Day of Month: Second Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Members:
None

LANCASTER

Secretary-Treasurer: George Geesey
317 East Poplar St., York, Pa.

Meeting Place: Varies

Day of Month: Second Friday
Time: 8:00 P.M.

Sustaining Members: None

LOS ANGELES

Secretary: Don Baudrand
791 E. 15th St., Los Angeles 21, Calif.

Meeting Place: Roger Young Auditorium, 926 W. Washington Blvd., Los Angeles, Calif.

Day of Month: Second Wednesday
Time: 8:00 P.M.

Sustaining Members:
Alert Supply Company, Los Angeles 22, Calif.
Associated Plating Co., Los Angeles, Calif.
The Barber-Webb Co., Inc., Los Angeles 58, Calif.
L. H. Butcher Co., Los Angeles 23, Calif.
Crown City Plating Co., El Monte, Calif.
Hall Mack Company, Los Angeles 7, Calif.
Mefford Chemical Co., Los Angeles 22, Calif.
Modern Plating Co., Los Angeles, Calif.
George E. Nichols Plating, Los Angeles, Calif.
Price Pfister Brass Mfg. Co., Los Angeles 31, Calif.
Rheem Automotive Co., Fullerton, Calif.
Standard Nickel-Chromium Plating Co., Los Angeles, Calif.
Surface Alloys Engineering Co., Huntington Park, Calif.
Turco Products, Inc., Los Angeles 54, Calif.
Virboe Bros. Manufacturing Co.

LOUISVILLE

Secretary-Treasurer: Harold G. Peters
2206 Sherwood Avenue, Louisville 5, Kentucky

Meeting Place: Hasenours Dining & Cocktail Lounge, 1028 Barrett Ave., Louisville, Kentucky

Day of Month: Third Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
American-Standard, Louisville, Ky.

MELBOURNE

Honorary Secretary: I. W. Rose
41 Glen Orme Ave., Ormand S.E. 14, Melbourne, Victoria, Australia

Secretary: P. Major
c/o Glen Walker & Co. Pty., Ltd., 11 Waterloo St., Carlton, Australia

Meeting Place: Metallurgy Theatre, Royal Melbourne Tech. College

Day of Month: Third Thursday
Time: 7:30 P.M.

Sustaining Members:
None

MIAMI

Secretary: Frank X. Marinello
5875 E. Fifth Ave., Hialeah, Florida

Meeting Place: Jerry's Restaurant, Lejuene Road Miami, Fla.

Day of Month: Third Wednesday
Time: 7:00 P.M.

Sustaining Members:
None

MILWAUKEE

Secretary-Treasurer: Frederick F. Padgett
4510 N. 22nd St., Milwaukee 9, Wis.

Meeting Place: Ambassador Hotel, Milwaukee, Wisc.

Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:
Acme Galvanizing, Inc., Milwaukee 15, Wisc.
Allen Bradley Co., Milwaukee 4, Wisc.
Cutler-Hammer, Inc., Milwaukee, Wisc.
Donald Sales & Mfg. Co., Milwaukee 13, Wisc.
Kohler Co., Kohler, Wisc.
Milwaukee Plating Co., Milwaukee 12, Wisc.
John Oster Mfg. Co., Milwaukee 17, Wisc.
Parker Pen Co., Janesville, Wisc.
Racine Plating Co., Inc., Racine, Wisc.
Square D Company, Milwaukee 12, Wisc.
S. K. Williams Co., Milwaukee 10, Wisc.

MISSISSIPPI VALLEY

Secretary-Treasurer: Stanley R. Neilsen
429 Holmes St., Bettendorf, Iowa

Meeting Place: Moline American Legion Hall, Moline, Ill.

Day of Month: Third Wednesday
Time: 8:00 P.M.

Sustaining Members:
Victor Casket Hardware Co., Galesburg, Ill.

MOHAWK VALLEY

Secretary-Treasurer: Carl Fenner
27 South Fifth Avenue, Ilion, N. Y.

Meeting Place: Thompson's Hotel, Yorkville, N. Y.

Day of Month: Second Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
None

MONTREAL

Secretary-Treasurer: R. W. Niggeman
4448 Beaconsfield Avenue, Montreal 28, Quebec, Canada

Meeting Place: Mount Royal Hotel, 1455 Peel St., Montreal, P. Q.

Day of Month: First Monday
Time: 8:30 P.M.

Sustaining Members:
Alloycraft, Ltd., Westmont, Montreal, Canada
Northern Electric Co., Ltd. Montreal, Quebec, Canada

NEWARK

Secretary: D. Gardner Foulke
455 Johnston Drive, Watchung, RFD 3, Plainfield, N. J.

Meeting Place: Robert Treat Hotel

Day of Month: Third Friday
Time: 8:15 P.M.

Sustaining Members:
American Smelting & Refining Co., South Plainfield, N. J.
Bell Telephone Laboratories, Murray Hill, N. J.
Corona Corp., Jersey City, N. J.
Frederick Gumm Chemical Co., Kearny, N. J.
Henson-Van Winkle-Munning Co. (2), Matawan, N. J.
Hy Grade Electro Plating Co., Newark 7, N. J.
International Nickel Company, Inc. (2), Bayonne, N.J.
Mass & Waldstein Co., Newark 4, N. J.
Sel-Rex Corporation, Nutley 10, N. J.

NEW HAVEN

Secretary-Treasurer: Bernard J. Gaffney
40 Filbert St., Hamden, Conn.
Meeting Place: Mason Laboratory—Yale University
Day of Month: Second Tuesday
Time: 8:00 P.M.

Sustaining Members:
Christie Plating Company, Groton, Conn.
Chromium Process Co., Shelton, Conn.
Enthone, Inc., New Haven 2, Conn.
Lycoming Div., AVCO Mfg. Corp., Stratford, Conn.

NEW YORK

Secretary-Treasurer: Milton Nadel
9-05 162nd St., Whitestone 57, N. Y.
Meeting Place: Hotel Statler
Day of Month: Second and Fourth Fridays
Time: 8:00 P.M.

Sustaining Members:
Allied Chemical Corp., Solvay Process Div., New York 16, N. Y.
Allied Chemical Corp., National Aniline Div., New York 6, N. Y.
American Zinc Institute, New York, N. Y.
Finishing Publications, Inc., Westwood, N. J.
International Nickel Company, Inc. (3), New York, N. Y.
Lea-Ronal, Inc., Jamaica 35, N. Y.
Lewco Metal Finishers, Inc., Long Island City 1, N. Y.
Metal & Thermit Corp. (2) New York 17, N. Y.
Oakite Products, Inc., New York 6, N. Y.
Photocircuts Corporation, Glen Cove, N. Y.
Sylvania Electric Products, Inc., Flushing, N. Y.

PHILADELPHIA

Secretary: I. William Marcovitch
1302 St. Vincent St., Philadelphia 11, Pa.
Meeting Place: Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia 7, Pa.
Day of Month: Fourth Monday
Time: 8:00 P.M.

Sustaining Members:
Accurate Electro-Plating, Inc., Philadelphia, Pa.
Aetna Electroplating Co., Inc., Philadelphia 11, Pa.
Amchem Products, Inc. Ambler, Pa.
General Plating Co., Trenton, N. J.
Leeds & Northrup, Philadelphia 44, Pa.
Pennsalt Mfg. Co., Philadelphia, Pa.
Philadelphia Rust Proof Co., Philadelphia 34, Pa.
Progress Mfg. Co., Inc., Philadelphia 34, Pa.
Radio Corporation of America, Camden 2, N. J.
The Reynolds Co., Philadelphia 32, Pa.

PITTSBURGH

Secretary: Edward B. Keller
1102 Sunday St., Pittsburgh 12, Pa.
Meeting Place: Gateway Plaza, Pittsburgh, Pa.
Day of Month: Second Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Aluminum Company of America, New Kensington, Pa.
Rockwell-Standard Corp., Standard Steel Spring Div., Coraopolis, Pa.
Weirton Steel Co., Weirton, West Va.
Westinghouse Electric Corp., East Pittsburgh, Pa.

PORTLAND

Secretary-Treasurer: George Bethell
L. H. Butcher Co., 2750 N. W. 31st
Portland, Oregon
Meeting Place: Old Country Kitchen
Day of Month: Open
Time: 6:30 P.M.

Sustaining Members:
None

PROVIDENCE-ATTLEBORO

Secretary: Edward G. Amesbury
35 Rocklawn Ave., Attleboro, Mass.
Meeting Place: Providence Engineering Society Building, 195 Angell St., Providence, R. I.
Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:
Gorham Manufacturing Co., Providence 7, R. I.
Walton & Lonsbury, Attleboro, Mass.

ROCHESTER

Secretary-Treasurer: Linwood P. Morrison
1240 Weiland Rd., Rochester 13, N. Y.
Meeting Place: Rochester German Club, Rochester, N. Y.
Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:
Eastman-Kodak Co. (2), Rochester 4, N. Y.
Stromberg-Carlson Co., Rochester, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Wollensak Optical Co., Rochester, N. Y.

ROCKFORD

Secretary-Treasurer: E. J. Budden
122 12th St., Rockford, Ill.
Meeting Place: Faust Hotel, Rockford, Ill.
Day of Month: Second Monday
Time: 7:00 P.M.

Sustaining Members:
National Lock Co., Rockford, Ill.

SAGINAW VALLEY

Secretary-Treasurer: George Savage
2921 Concord, Flint 4, Mich.
Meeting Place: Zehnder, Frankenmuth, Michigan
Day of Month: Second Wednesday
Time: 6:45 P.M.

Sustaining Members:
None
American Buff Co., Chicago 6, Illinois

ST. JOSEPH VALLEY

Secretary: Henry A. Meers
2001 Bergan St., South Bend, Ind.
Meeting Place: Lincoln Highway Inn, Mishawaka, Ind.
Day of Month: First Wednesday
Time: 7:00 P.M.

Sustaining Members:
Bendix Aviation Corp., Bendix Prods. Div., South Bend 20, Ind.
Rockwell-Standard Corp., Mishawaka, Ind.
Roth Plating Corporation, South Bend, Ind.
Standard Plating Works, Inc., Goshen, Ind.
The Studebaker-Packard Corp., South Bend, Ind.

ST. LOUIS

Secretary: Ward W. Kelly
7046 Deerpath Drive, St. Louis 23, Mo.
Meeting Place: York Hotel, Sixth St. & Market St St. Louis, Missouri
Day of Month: Second Wednesday
Time: 7:00 P.M.

Sustaining Members:
American Zinc Sales Co., St. Louis, Mo.
Bussman Mfg. Co., St. Louis, Mo.
Chandeysson Electric Co., St. Louis, Mo.
Davies Supply & Mfg. Co., St. Louis 16, Mo.
Folding Carrier Corp., Oklahoma City, Okla.
C. Hager & Sons Hinge Mfg. Co., St. Louis 5, Mo.
Knapp-Monarch Co., St. Louis 16, Mo.
Laselco, Inc., St. Louis 4, Mo.
Maurer Supply Co., St. Louis, Mo.
National Rejectors, Inc., St. Louis 15, Mo.
G. S. Robins Co., St. Louis 8, Mo.
Sommers Brothers Mfg. Co., St. Louis 7, Mo.

SAN ANTONIO

Secretary-Treasurer: Katherine D. Christians
106 Pool Drive, San Antonio 10, Texas
Meeting Place: Terry Industries, Inc., 2805 S. Flores St., San Antonio, Texas

Day of Month: Third Monday
Time: 7:30
Sustaining Members:
None

SAN FRANCISCO

Secretary-Treasurer: Richard T. Coen
437 Ulloa St., San Francisco, California
Meeting Place: International Inn, South San Francisco, Calif.
Day of Month: Second Thursday
Time: 7:00 P.M.
Sustaining Members:
Schlage Lock Co., San Francisco, Calif.

SEATTLE-PUGET SOUND

Secretary: Mrs. Helen Archibald
17814 Palatine, Seattle, Wash.
Meeting Place: College Club, 6th & Spring Sts., Seattle, Wash.
Day of Month: Third Tuesday (Flexible)
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.
Sustaining Members:
Kaiser Aluminum & Chemical Corp. Spokane, Wash.

SOUTHEASTERN

Secretary: H. R. Stogner Sr.
3019 Tilson Road, Decatur, Georgia
Meeting Place: Belmont Steak House, Downtown Luckie St., Atlanta, Ga.
Day of Month: Second Friday
Time: 7:30 P.M.
Sustaining Member:
Production Plating Company, Adel, Ga.

SOUTHERN TIER

Secretary: Bill Rossiter
5 Ellen St., Rt. 97, Binghamton, N. Y.
Meeting Place: Carlton Hotel, Binghamton, N. Y.
Day of Month: Third Tuesday
Time: 7:15 P.M.
Sustaining Members:
International Business Machines Corp., Endicott, N. Y.

SPRINGFIELD

Secretary: Henry L. Heissfeld
74 Chilson St., Springfield, Mass.
Meeting Place: Blake's Restaurant, 15 Market St., Springfield, Mass.
Day of Month: Fourth Monday
Time: Dinner 7:00 P.M.—Technical Session 8:00 P.M.
Sustaining Members:
The Chemical Corporation, Springfield, Mass.
Moore Drop Forging Co., Springfield, Mass.

SYDNEY

Secretary-Treasurer: M. R. MacKinnon
3 Hyde Brae St., Strathfield, New South Wales, Australia
Meeting Place: Trust Building, Martin Place & Castlereigh St.
Day of Month: Second Thursday
Time: 7:30 P.M.
Sustaining Members:
None

SYRACUSE

Secretary: Robert A. Carpenter
138 Oakland St., Syracuse, N. Y.
Meeting Place: Turn Hall, 619 N. Salina St., Syracuse, N. Y.
Day of Month: Third Monday
Time: Dinner 6:45 P.M.—Meeting 8:00 P.M.
Sustaining Members:
Oneida, Ltd., Oneida, N. Y.

Special Contributions to Research Fund, (1958-1959): American Society for Testing Materials and AES Branches: Central Michigan, Cincinnati, Cleveland, Detroit, Indianapolis, Rochester, Toronto and Western Ontario. Foreign Sustaining Members: Ingaico S. R. L. Co., Buenos Aires, Argentina.

TOLEDO

Secretary-Treasurer: Ben Gomersall
6015 Anthony Wayne Trail, Route 1, Maumee, Ohio
Meeting Place: Angelo's Spaghetti House, Stickney Ave., Toledo, Ohio
Day of Month: First Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.
Sustaining Member:
The Electric Auto-Lite Co. (2), Sharonville 8, Ohio

TORONTO

Secretary: R. H. Clark
262 Woburn Avenue, Toronto, 12, Ontario, Canada
Meeting Place: Royal York Hotel, Toronto, Ontario, Canada
Day of Month: Second Friday
Time: Dinner 6:30 P.M.—Meeting 8:30 P.M.
Sustaining Members:
Armalite Company, Ltd., Toronto, Ontario, Canada
Bomac Electrotype Co., Ltd., Toronto, Ontario, Canada
British Chrome & Chemicals (Canada) Ltd., Toronto 5, Ontario, Canada
Canada Cycle & Motor Co., Ltd., Weston, Ontario, Canada
Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario, Canada
General Motors of Canada, Ltd., Oshawa, Ontario, Canada
Houdaille Industries of Canada, Ltd., Oshawa, Ontario, Canada
International Business Machines Co.
International Nickel Co. of Canada, Ltd., (3) Toronto, Ontario, Canada
Lea Manufacturing Co. of Canada, Ltd., Scarborough, Ontario, Canada
Metal & Thermit—United Chromium of Canada, Ltd., Rexdale, Ontario, Canada
W. W. Wells, Ltd., Scarborough, Ontario, Canada

TWIN CITY

Secretary-Treasurer: Robert L. Buckley
205 11th Ave., South, Minneapolis 15, Minn.
Meeting Place: Jax Cafe, Minneapolis, Minn.
Day of Month: First Monday
Time: 7:00 P.M.
Sustaining Members:
None

WATERBURY

Secretary-Treasurer: Albert G. Griffith
94 Ridgeview Place, Cheshire, Conn.
Meeting Place: Colonial Room, Roger Smith-Elton Hotel
Day of Month: Second Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.
Sustaining Members:
American Brass Company, Waterbury 20, Conn.
American Electro Products, Inc., Waterbury, Conn.
American Chemical & Refining Co., Waterbury, Conn.
Apothecaries-Hall Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chromium Corporation of America, New York, N. Y.
Eastern Electroplating Co., Terryville, Conn.
Harper Leeder, Inc., Waterbury 20, Conn.
The International Silver Co., Meriden, Conn.
The Lea Mfg. Co., Waterbury 20, Conn.
Lux Clock Manufacturing Co., Waterbury, Conn.
MacDermid, Inc., Waterbury 20, Conn.
The Patent Button Co., Waterbury 2, Conn.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
The Summit Finishing Co., Inc., Thomaston, Conn.
Wallace Silversmiths, Inc., Waterbury, Conn.
The Waterbury Plating Co., Waterbury 86, Conn.
Whyco Chromium Co., Inc., Thomaston, Conn.

WESTERN ONTARIO

Secretary-Treasurer: Robert Dobson
Box 41, Watford, Ontario, Canada
Meeting Place: William Pitt Hotel, Chatham, Ontario, Canada
Day of Month: Third Friday
Time: 7:00 P.M.—Dinner-Meeting
Sustaining Members:
Bendix Eclipse of Canada, Ltd., Windsor, Ontario, Canada
Canadian Motor Lamp Co., Ltd., Windsor, Ontario, Canada
Ontario Steel Products Co., Ltd., Chatham, Ontario, Canada

WICHITA

Secretary: Richard Bartholomew
2029 Ohio, Augusta, Kansas
Meeting Place: Oriental Restaurant, 5405 E. Central, Wichita, Kas.
Day of Month: Fourth Wednesday
Time: 6:30 P.M.
Sustaining Members:
None

GREETINGS GREETINGS

A HALF CENTURY OF SERVICE TO ELECTROPLATING, METAL FINISHING AND ALLIED ARTS

GOLDEN JUBILEE 1959

"As Governor of Michigan, it is my great pleasure to send the greetings and best wishes of the people of our great state to the American Electroplaters' Society on the occasion of its Golden Jubilee.

"It will be the privilege and honor of Michigan citizens to host the 50th Anniversary Convention of the American Electroplaters' Society in June, 1959. It is fitting that the Motor City of Detroit and the state that literally put the world on wheels should enjoy the distinction of hosting this Golden Jubilee Convention. The numerous contributions that the Society and its members have made to increased scientific knowledge and improved technology have had a broad impact on the national economy. Through your efforts and accomplishments, we today enjoy better products and a high standard of living.

"You will find in Detroit a dynamic industrial complex. Much of this springs from the work of members of your Society in the electroplating, metal finishing and allied arts. I know you will find superb hospitality and a rewarding experience as you convene in Detroit this June. It is my sincere hope to greet you at that time and extend, in person, the best wishes of Michigan and its people."

G. MENNEN WILLIAMS
Governor
State of Michigan

"I am pleased to send the American Electroplaters' Society my warm greetings on its Golden Jubilee. As the Society marks its fiftieth year of scientific and technical achievement, its members may be justly proud of their contributions to progress in a field so important to us all.

"I congratulate you on your anniversary. May the Society's next fifty years be as rewarding!

"With best wishes"

JOHN HAY WHITNEY
United States Ambassador
to the
Court of St. James

"It is a pleasure to welcome your Society to Detroit and to congratulate you on your 50th Anniversary.

"It is only appropriate that your Golden Jubilee Convention and Exposition be held in our city. Detroit is one of the leading plating centers in the world and its leading industry—the automotive—one of the largest users. Much of the plating research is today being conducted in this area.

"Your Society is well-known to Detroiters for the tremendous job it is doing in promoting technical and scientific advancement in electroplating, metal finishing and the allied arts.

"Any assistance that our organization can give in making your convention the best ever, is yours for the asking.

"May your stay in Detroit be profitable and pleasant!"

WALTER L. COUSE
President
Detroit Chamber of Commerce

"Thank you for your letter of October 18 telling me about the plans for your Golden Jubilee Convention in Detroit next June. From it I was delighted to see that so many representatives of Great Britain will be attending the Convention.

"Please convey to your Society my warm greetings on the occasion of its Fiftieth Anniversary. Such a Golden Jubilee is an occasion not only to look back on the memories of a successful past, but to gain inspiration for continued advance in the years to come. This is, I know, your purpose, and I wish you and your members all good luck."

SIR HAROLD CACCIA
Her Brittanic Majesty's
Ambassador to the United States

"From this page of the **GOLDEN JUBILEE** issue of your own special periodical, I extend a sincere greeting to all members of the American Electroplaters' Society with, naturally enough, special regard to the Canadians amongst you.

"My hearty congratulations go out to all on the occasion of this **FIFTIETH ANNIVERSARY** of your incorporation as an international professional association.

"May the observance planned to mark your Jubilee be successful in all respects, and may the next half-century bring the Society even more well-merited recognition and achievement than the one just ended."

GORDON CHURCHILL
Minister of Trade and Commerce
Dominion of Canada

"In the home, in the office, in the factory, on the highways and skyways—everywhere you look today, you can see the products of electrodeposition. And yet, with all the visual proof constantly before him, the average man fails to realize the vast ways in which the science of electroplating has improved our standard of living.

"Representative of this vital industry is the American Electroplaters' Society, a dynamic and progressive organization. It is fitting that a dynamic Society should hold its convention in Detroit, for Detroit is known as the Dynamic City. And we of this City are looking forward to the forthcoming Golden Jubilee Convention and Exposition to be held in Detroit from June 15 to 19, 1959. We offer you a warm welcome and the friendship of an industrious and forward-looking people.

"Detroit is one of America's truly great cities—fifth largest in population—rich in history and tradition—a world port—international in aspect—an industrial giant in peace or war—and with all of this, a city of beauty, culture and gracious living.

"You will be well-provided for as you convene here and enjoy the manifold attractions that this City affords."

LOUIS C. MIRIANI
Mayor
City of Detroit

G. Mennen Williams

Sir Harold Caccia

John Hay Whitney

Gordon Churchill

Louis C. Miriani

Walter L. Couse

GREETINGS GREETINGS

A HALF CENTURY OF SERVICE TO ELECTROPLATING, METAL FINISHING AND ALLIED ARTS
GOLDEN JUBILEE 1959

" 'DETROIT's The Place In '59!' This has been our slogan ever since the GOLDEN JUBILEE Convention planning started.

"Detroit, the center of the plating industry, has the largest plating installations in the world. One of these will be seen in a planned plant visitation.

"The Fifth International Conference on Electrodeposition and Metal Finishing will be a feature of the Golden Jubilee Convention. The Educational Committee has secured papers from authorities with world-wide reputations.

"The Convention Committee has planned special events in keeping with the AES's Fiftieth Anniversary. The Fifth Industrial Finishing Exposition will show you the latest equipment to surface-treat your products efficiently.

"For the men, Detroit's Convention Committee has worked diligently to give you an outstanding educational program, with time to see the latest in equipment. For the ladies, the Committee has a program which will keep them busy and entertained, with such events headlined as a champagne breakfast; a trip on Lake St. Clair in an ocean liner, the S.S. Aquarama; a styling show about automobiles instead of fashions, others.

"The Convention Committee will be extremely disappointed if you do not take advantage of this outstanding program planned particularly for YOU. Welcome and every good wish for a memorable GOLDEN JUBILEE stay in Detroit."

WRIGHT W. WILSON
General Convention Chairman

"On behalf of the International Council, it is my privilege and sincere pleasure to welcome you to the Fifth International Conference on Electrodeposition and Metal Finishing. The Council feels confident that it has arranged a program for you which is of an extremely high caliber. Noted authors from ten countries of the world will collaborate in placing before you their knowledge of various phases of metal finishing.

"A very special welcome is extended our overseas guests with the hope that they will feel well rewarded for having come so far to be with us. It is in a spirit of humility and deep gratitude that I, as an individual, am afforded the pleasure of welcoming them, with the knowledge that in doing so, I am reciprocating in some small measure for the kind courtesies extended me at a previous International Conference in England.

"I shall hope that all of our guests will profit by their attendance at the many functions which will constitute our Golden Jubilee Convention. A very considerable amount of effort has been expended in planning for these activities. Your participation in the events, and the firm belief that you will benefit from them, is all the reward we could expect."

W. L. PINNER
Chairman
International Council on
Electrodeposition and Metal Finishing

"Permit me to extend a warm and cordial welcome to your attendance at the largest Industrial Finishing Exposition in history.

"Assembled here, in the very heart of the automotive industry, you will find over 100,000 square feet of floor space being used by approximately 150 leading manufacturers of electroplating equipment and finishing supplies for displaying their wares.

"Here you will also find the industry's top authorities manning the booths. These are the men who engineer, design, build and sell finishing equipment and supplies. Their very business depends on solving problems that involve improvement of work quality, increased production and reduction of over-all metal finishing costs. So plan to bring your finishing problems along and discuss them with this talented group.

"Because we are so proud of the automobiles Detroit produces, we're going to give several of them away as free prizes. May good fortune be with you!"

HOWARD J. McALEER
Chairman
Fifth Industrial Finishing Exposition

"It is with the greatest pleasure that I send this letter of welcome to the Fifth International Conference on Electrodeposition and Metal Finishing of which your Society is on this occasion the host.

"In 1954, the Institute of Metal Finishing which joins with you in providing the International Council for Electrodeposition and Metal Finishing, was host for the Fourth International Conference held in London. On that occasion, we had the pleasure of welcoming a large number of your members, and we are hoping over here, to provide a similar representative body of our members to be with you in June.

"We all know that your Society will do a splendid job of organizing a Conference of a really outstanding kind, and we are looking forward very much to participating in it. We are particularly delighted that the Conference will coincide with your coming Golden Jubilee Convention and celebrations. May the next fifty years be as flourishing for your Society as the past."

DR. T. P. HOAR
President
Institute of Metal Finishing (London)

"To the members of AES and to their families and guests who will honor us with their presence at the AES's GOLDEN JUBILEE Convention, Industrial Finishing Exposition and Fifth International Conference on Electrodeposition and Metal Finishing to be held in our City June 15-19, 1959 with our Detroit Branch as Host, we extend a most hearty welcome and the hope that for you, this week will abound with educational enrichment plus enjoyment and good fellowship."

DONALD M. BIGGE
President
AES Detroit Branch

W. L. Pinner

Wright W. Wilson

Donald M. Bigge

Howard J. McAleer

Dr. T. P. Hoar

AES HONORS ITS LIVING FOUNDING FATHERS

William Schneider
New York Branch

Justus A. Stremel
New York Branch

Edward W. T. Faint
Newark Branch

Frederick F. Pierdon
Baltimore-Washington Branch

Harry C. Bernard
New York Branch

BEFORE THE SUPREME SOCIETY

AGENDA
FIRST BUSINESS SESSION

GRAND BALLROOM
STATLER-HILTON HOTEL, DETROIT
MONDAY MORNING, JUNE 15, 1959

1. **Call to Order, GOLDEN JUBILEE ANNUAL MEETING.**
2. **Roll Call of Officers.**
3. **Report of Credentials Committee.**
4. **Roll Call of Delegates.**
5. **In Memoriam.**
6. **Reports of Officers (Published Copies in DELEGATES KITS):**
   (a) President
   (b) First Vice President
   (c) Second Vice President
   (d) Third Vice President
   (e) Past President
   (f) Executive Secretary
7. **Reports of Standing and Special Committees (Copies in DELEGATES KITS).**
8. **Report on New Branches.**
9. **1958–1959 Financial Statement and 1959–1960 Budget (Copies in DELEGATES KITS).**
10. **Report of Paper Awards Committee and Presentation of Awards.**
11. **Announcement of Board Appointments To:**
    (a) Editorial Board
    (b) Research Committee
    (c) Public Relations Committee
    (d) Election Committee
    (e) Honorary Membership Awards Committee
    (f) Educational Committee
    (g) Membership Committee
    (h) Publications Committee
    (i) Scientific Achievement Award Committee
12. **Presentation, Proposed Revisions, Constitution and Bylaws.**
13. **Business Brought for Discussion by Delegates.**
14. **Recess of GOLDEN JUBILEE ANNUAL MEETING.**

AGENDA
SECOND BUSINESS SESSION

WAYNE ROOM, STATLER-HILTON HOTEL
THURSDAY, JUNE 18, 1959

1. **Call to Order, GOLDEN JUBILEE ANNUAL MEETING.**
2. **Roll Call of Officers.**
3. **Roll Call of Delegates.**
4. **Roll Call of Living Past Presidents.**
5. **Financial Statement (1958–1959) and Proposed Operating Budget (1959–1960)**
   (a) Action on Proposed Constitutional and Bylaw Amendments proposed by Sixth Interim Meeting of Supreme Society and sponsored by Five or More Branches:
   (1) **Per Capita Tax Increase—**
   Constitution Part I, Article V, Section 3.
   Bylaws Part I, Article V, Section 2, 3.
   Bylaws Part II, Article V, Section 5.
   Bylaws Part II, Article VIII, Section 1.
   (2) **September 1 Per Capita Tax Due-Date—**
   Bylaws Part I, Article V, Section 2.
   Bylaws Part II, Article V, Section 5.
   (b) Action on Proposed Operating Budget (1959–1960).
6. **Action on Other Proposed Constitutional and Bylaw Amendments:**
   (a) **Honorary Member Dues—**
   Constitution Part I, Article V, Section 2.
   (b) **Election of Officers—**
   Constitution Part I, Article IV, Section 1.
   (c) **Minutes of Annual Meeting—**
   Constitution Part I, Article VIII, Section 3.
   (d) **Branch Exhibits—**
   Bylaws Part I, Article III, Section 14.
   Bylaws Part I, Article VI, Section 8.
   (e) **Interim Meeting—**
   Bylaws Part I, Article VI, Section 9.
7. **Report on Membership Competition. Presentation of Awards.**
8. **Action on Nominees for AES Honorary Membership. Announcement of Award of Merit winners.**
9. **Reports of Special Committees:**
   (a) Appraisal Committee as to the Need for a Convention Planning Committee.
   (b) Appraisal Committee as to the Need for a Long-Range Planning Committee.
10. **Introduction of 1959 "AES Scientific Achievement Award Winner".**
11. **Business Brought for Discussion by Delegates.**
12. **Discharge of 1958–1959 Special Committees.**
13. **Nominations and Election of 1959–1960 Officers:**
    (a) President
    (b) First Vice President
    (c) Second Vice President
    (d) Third Vice President
14. **Installation Ceremony.**
    (a) Installation of Newly Elected Officers.
    (b) Presentation of Gavel to New President.
    (c) Presentation of Plaque and Past President's Pin to Retiring President.
15. **Report by:**
    (a) GOLDEN JUBILEE Convention General Chairman.
    (b) Industrial Finishing Exposition Chairman.
    (c) Fifth International Conference on Electrodeposition and Metal Finishing Chairman.
    (d) National Executive Secretary as to year-long GOLDEN JUBILEE observance and results.
16. **Reports by Future Convention Chairmen (Los Angeles, Boston, Milwaukee, Atlantic City).**
17. **Selection of Convention Cities—1964 and 1965.**
18. **Selection of Interim Meeting Site(s) and Setting of Date(s).**
19. **Resolution of Thanks to Detroit Branch, GOLDEN JUBILEE CONVENTION Host.**
20. **Adjournment of GOLDEN JUBILEE ANNUAL MEETING.**

PROGRAM

GOLDEN JUBILEE CONVENTION AND INDUSTRIAL FINISHING EXPOSITION
AMERICAN ELECTROPLATERS' SOCIETY, INC.

HOTEL STATLER-HILTON, DETROIT, AND ARTILLERY ARMORY, OAK PARK, JUNE 15–19, 1959

SUNDAY, JUNE 14

9:00 a.m.	Executive Board Meeting (All Day)	Hq. Room (Parlor B)
1:00–8:00 p.m.	Convention Registration	Foyer
3:00–5:00 p.m.	Ladies Tea (Sponsored by Siefen Compounds, Inc.)	English Room
4:00 p.m.	Credentials Committee Meeting	Parlor B
4:00 p.m.	AES Scientific Achievement Award Committee Meeting	Parlor F
8:00 p.m.	Golden Jubilee Get-Together Party	Grand Ballroom

MONDAY, JUNE 15

8:30 a.m.– 5:30 p.m.	Convention Registration	Foyer
10:00 a.m.	Grand Opening, Golden Jubilee Convention	Grand Ballroom
	CALL TO ORDER: Wright W. Wilson, General Chairman	
	INVOCATION: Rev. Canon Irwin C. Johnson, St. John's Episcopal Church	
	DETROIT'S WELCOME: Hon. Louis C. Miriani, Mayor of Detroit	
	AES RESPONSE: National President Herberth E. Head	
	MICHIGAN'S GREETINGS: Hon. G. Mennen Williams, Governor of Michigan	
	AWARDS: Announcement of winner Scientific Achievement Award by Dr. Abner Brenner, Chairman, Selection Committee	
	KEYNOTE ADDRESS: Irving A. Duffy, Vice President, Ford Motor Co.	
11:00 a.m.	Business Meeting, Supreme Society	Grand Ballroom
12:00 noon	Branch Secretaries' Luncheon	English Room
12:00 noon	Speakers' Luncheon	Parlor E
12:00 noon	Ladies Program. Luncheon at Detroit Yacht Club (Co-sponsored by Allied Research Products, Inc., and Pillsbury Chemicals). Special Entertainment	Bus from Statler-Hilton
1:00–5:00 p.m.	Convention Registration	Artillery Armory
2:00 p.m.	Opening Educational Session A, Fifth International Conference on Electrodeposition and Metal Finishing	Grand Ballroom
3:00 p.m.	Editorial Board Meeting	Parlor E
4:30 p.m.	Order of Past Presidents, Business Meeting	Parlor F
6:30 p.m.	Past Presidents' Dinner	English Room
8:00 p.m.	AES Golden Jubilee Open House (Sponsored by Metal Finishing Suppliers' Association) Crystal, Grand and Founders Ballrooms	Sheraton-Cadillac

TUESDAY, JUNE 16

8:00 a.m.	Research Committee Breakfast	Parlor F
8:00 a.m.	Speakers' Breakfast	Parlor C
8:30 a.m.–1 p.m.	Convention Registration	Foyer
9:00 a.m.	Educational Session B, International Conference	Grand Ballroom
9:00 a.m.	Educational Session C, International Conference	Michigan Room
9:00 a.m.	Research Committee Meeting	Parlor F
9:00 a.m.	Educational Committee Meeting	Parlor E
9:30 a.m.	Plant Visit, Ford Motor Company (Rouge Plant), Dearborn, Michigan	Bus from Statler-Hilton
10:00 a.m.–5:00 p.m.	Convention Registration	Artillery Armory
10:00 a.m.–9:00 p.m.	Industrial Finishing Exposition	Artillery Armory
11:00 a.m.	Ladies Program. Trip to Dearborn Inn—Luncheon and Entertainment (Sponsored by Oakite Products, Inc.), followed by Tour of Edison Institute and Greenfield Village	Bus from Statler-Hilton
12:00 noon	Branch Librarians' and Educational Committee Luncheon	English Room
12:00 noon	Speakers' Luncheon	Parlor C
2:00 p.m.	Opening Ceremony, Fifth Industrial Finishing Exposition	Artillery Armory
2:00 p.m.	Research Committee Meeting	Parlor F
2:30 p.m.	Educational Session D, International Conference	Artillery Armory

WEDNESDAY, JUNE 17

8:00 a.m.	Membership Committee Breakfast	Parlor F
8:00 a.m.	Speakers' Breakfast	Parlor E
8:30 a.m.–1 p.m.	Convention Registration	Foyer
8:30 a.m.	Golden Jubilee Golf Tournament (Sponsored by MFSA)	Pine Lake Country Club, Pontiac
8:45 a.m.	Ladies Program. Lake St. Clair Cruise on the S.S. Aquarama (Luncheon) (Co-sponsored by J. J. Siefen Co. and Northwest Chemical Co.)	Cabs from Statler-Hilton
9:00 a.m.–12:00 noon	Registration	Foyer
9:00 a.m.	Public Relations Committee Meeting	English Room
9:00 a.m.	Membership Committee Meeting	Parlor F
9:00 a.m.	Midwest Regional Council Meeting	Parlor B
9:00 a.m.	Educational Session E, International Conference	Grand Ballroom
9:00 a.m.	Educational Session F, International Conference	Michigan Room
9:30 a.m.	Plant Visit, Chrysler Engineering Laboratory	Bus from Statler-Hilton
10:00 a.m.–5:00 p.m.	Convention Registration	Artillery Armory
10:00 a.m.–9:00 p.m.	Industrial Finishing Exposition	Artillery Armory
1:00 p.m.	Publications Committee Meeting	Parlor B
2:00 p.m.	East-West GOLDEN JUBILEE Championship Baseball Game	Artillery Armory Grounds
4:00 p.m.	Golden Jubilee Outing (Millionaire's Party, followed by Barbecue)	Artillery Armory Grounds

(Continued on the next page)

(Program Continued From Previous Page)

AES GOLDEN JUBILEE CONVENTION AND INDUSTRIAL FINISHING EXPOSITION

THURSDAY, JUNE 18

8:00 a.m.	Speakers' Breakfast	Parlor F
8:30 a.m.–1 p.m.	Convention Registration	Foyer
9:00 a.m.	Business Meeting, Supreme Society	Wayne Room
9:00 a.m.	Educational Session G, International Conference	Grand Ballroom
9:00 a.m.	Plant Visit, General Motors Technical Center, Warren, Michigan	Bus from Statler-Hilton
10:00 a.m.–4:00 p.m.	Industrial Finishing Exposition	Artillery Armory
11:00 a.m.	Ladies Program. Brunch at Devon Gables, Bloomfield Hills (Sponsored by The Udylite Corp.) followed by Auto Styling Show at Chrysler Corporation and Tea	Bus to Chrysler from Statler-Hilton
12:00 noon	Speakers' Luncheon	Parlor F
2:00 p.m.	Business Meeting, Supreme Society	Wayne Room
2:30 p.m.	Educational Session H, International Conference	Grand Ballroom
7:00 p.m.	Golden Jubilee Banquet, Floor Show and Dance	Statler-Hilton

FRIDAY, JUNE 19

8:00 a.m.	President's Breakfast (National Officers and Wives)	President's Suite
8:00 a.m.	Speakers' Breakfast	Parlor F
8:30 a.m.	Ladies Program. Ford Motor Company Tour and Luncheon	Bus from Statler-Hilton
9:00 a.m.	Executive Board Meeting	Parlor B
9:00 a.m.	Educational Session I, International Conference	Grand Ballroom
9:00 a.m.	Educational Session J, International Conference	Michigan Room
10:00 a.m.–6:00 p.m.	Industrial Finishing Exposition	Artillery Armory
12:00 noon	Speakers' Luncheon	Parlor F
2:30 p.m.	Educational Session K, International Conference	Artillery Armory

SESSION A

Dr. T. P. Hoar
England

SESSION B

G. Ross Davidson
Canada

SESSION C

Leslie L. Diveley
United States

SESSION D

William M. Phillips
United States

SESSION E

Clarence H. Sample
United States

SESSION F

Ralph D. Wysong
United States

SESSIONS CHAIRMEN
FIFTH INTERNATIONAL CONFERENCE
ON
ELECTRODEPOSITION AND METAL FINISHING

SESSION G

Dr. S. Wernick
England

SESSION H

Ezra A. Blount
United States

SESSION I

A. W. Wallbank
England

SESSION J

A. A. B. Harvey
England

SESSION K

Dr. Abner Brenner
United States

PROGRAM

INTERNATIONAL CONFERENCE

on

ELECTRODEPOSITION AND METAL FINISHING

THE EDUCATIONAL SESSIONS PHASE OF

GOLDEN JUBILEE CONVENTION, AMERICAN ELECTROPLATERS' SOCIETY

HOTEL STATLER-HILTON, DETROIT, and ARTILLERY ARMORY, OAK PARK, MICHIGAN

JUNE 15-19, 1959

MONDAY, JUNE 15

2:00 p.m. Educational Session ..... Grand Ballroom

SESSION A

Chairman—Dr. T. P. Hoar, Institute of Metal Finishing, *England*

THE WILLIAM BLUM LECTURE—EDUCATION AND THE ELECTROPLATING INDUSTRY
by Dr. William Blum, *United States*

The electroplating industry should prepare to take its proper place in our complex civilization, and to meet the challenge of the space age. To do so it is necessary to educate not only apprentices and foreman platers, but also works chemists, research chemists, plant executives, design engineers, and the general public who purchase plated products. Channels for such education are suggested.

PROBLEMS ENCOUNTERED IN THE APPLICATION OF PRE-FINISHED METAL
by Dr. S. Wernick, Institute of Metal Finishing, *England*

The general advantage, cost reduction and value to industry accruing from the use of pre-finished metal are indicated. Problems involved in using such material, arising from the nature and properties of the coating, are discussed. Stress is laid on the fact that pre-finished metal represents a challenge to the Industry which can only be met by improvement in the quality of metal finishes.

DEVELOPMENT AND APPLICATION OF ULTRASONIC CLEANING
by J. Zucker, Technochemie, AG, *Switzerland*

EXPERIMENTAL STUDIES OF THE ELECTRODEPOSITION OF METALS IN NARROW CREVICES
by Dr. Henry Leidheiser Jr. and Mrs. Lucille B. Garmon, Virginia Institute for Scientific Research, *United States*

This paper represents the first progress report of AES Research Project No. 17. It describes and summarizes results of experiments to determine the important variables which influence the distribution of an electrodeposit on a micro scale. Selected experimental results are reported on cobalt, copper, iron, nickel, silver, and zinc baths, and on tin-nickel alloy baths, although the majority of the experimental work has been with various nickel baths.

TUESDAY, JUNE 16

9:00 a.m. Educational Session ..... Grand Ballroom

SESSION B

Chairman—G. Ross Davidson, Canadian Hanson & Van Winkle Co., Ltd., *Canada*

A BLACK CHROMIUM PLATING PROCESS
by Dr. A. Kenneth Graham, Graham, Savage & Associates, Inc., *United States*

A black chromium plating process has been developed which may be operated over a relatively low current density range of about 150 to over 450 asf, at temperatures from 70 to 100F, with cathode efficiencies from about 6 to 15 per cent. Uniformly deep black deposits result. Coating thickness can be varied as desired and its wear resistance is 2.5 to 3 times that of bright nickel. The coating is readily wettable with either oil or water and may find application as a substitute for hard or porous chromium. For decorative applications oil, wax or organic supplemental coatings may be applied to improve the luster. The protective value of the coating may be varied with or without supplemental coatings. The coating may be applied to any basis metal that can be readily plated.

Dr. William Blum

Dr. S. Wernick

Dr. H. Leidheiser Jr.

Mrs. L. B. Garmon

Dr. A. K. Graham

LEVELING POWER OF COPPER SULFATE BATHS WITH COMPLEXING ADDITION AGENTS

by Dr. Eugenio Bertorelle, Dr. I. R. Bellobono, Dr. A. Scarati and Carlo Bernasconi, Istituto Tecnico per Chimici, *Italy*

Leveling power in an acid copper electrolyte consisting in a 0.5 Molar solution of $CuSO_4.5H_2O$ and 0.25 Molar solution of H_2SO_4, was examined in the presence of organic addition agents, able to form complexes of different stability with cupric ions. In most cases a field oriented growth was observed. The leveling power was evaluated by means of a standard "pseudosinusoidal" microprofile, with an amplitude of 50 microns, performing several metallographic measurements after various electroplating times.

PLATING ZINC ON STEEL FROM PYROPHOSPHATE SOLUTION—A PILOT PLANT INVESTIGATION

by U. F. Marx and D. Povey, Wilmot Breeden Laboratories, *England*

A pilot plant investigation of the electrodeposition of zinc on steel from zinc pyrophosphate solution is described. The optimum operating conditions and the effects of departing from them are reported. Data for electrode polarization, throwing power, hardness, structure and corrosion resistance of the deposits are recorded and compared with those for a zinc cyanide solution. While no firm conclusion can be reached about the relative operating costs of pyrophosphate and cyanide solutions, it appears that when all factors, including effluent disposal, are taken into consideration, the comparison will favor the pyrophosphate solution.

ELECTRODEPOSITION OF NICKEL ALLOYS FROM THE PYROPHOSPHATE BATH

by Dr. T. L. Rama Char, Indian Institute of Science, *India*

A detailed study has been made of the effect of variables on cathode efficiency, cathode potential, and composition of alloy deposits of nickel with tin, copper, zinc, cobalt and iron from the complex pyrophosphate bath. A wide range of alloy composition is possible. In the nickel-zinc system sudden changes occur in plate composition and cathode potential at low current density. At higher current densities the deposit composition was practically constant except with nickel-copper. Preliminary work has indicated possibilities of depositing alloys of nickel with manganese, tungsten and molybdenum from this bath.

9:00 a.m. Educational Session ..... **Michigan Room**

SESSION C

Chairman—Leslie L. Diveley, Cutler-Hammer Inc., *United States*

CHEMICAL CONVERSION COATINGS

by Robert F. Ayres, Oakite Products, Inc., *United States*

Various types of chemical conversion coatings, including oxides, phosphates and chromates, are defined, described and compared, and the distinction between deposits on the surface and conversion of the surface is illustrated. Experiments are reported relative to oxide components and co-precipitants in phosphate coatings, as well as the formation of stable chromium conversion coatings, and explanatory theories are discussed.

THE METAL SURFACE CONVERSION COATING AS A PAINT BASE

by Dr. Robert C. Gibson, Adrian College, *United States*

The value of phosphate, chromate and oxide coatings, singly or mixed as bases for organic coatings on steel, zinc and aluminum surfaces is widely recognized. This paper discusses the manner in which these coatings perform their intended function and the preparation of the basis metals, and theory of the mechanism of formation of phosphate coatings. Importance of processing details with respect to performance of the coatings is also emphasized. A treatment which forms an amorphous oxide-chromate type of coating on aluminum and its alloys makes the surface receptive to paints.

THE ACCELERATED WEATHERING OF ORGANIC FINISHES

by A. A. B. Harvey, Sunbeam Anti-Corrosives Limited, *England*

Accelerated weathering cycles consist of exposure to light, heat, moisture and corrosive vapors, separately and in combination. Three systems of irradiation with subsidiary chemical treatments are compared and the degree of correlation claimed with natural weathering assessed. The necessity for careful interpretation of results against a wide background of natural exposures, and the dangers of making life prognostications are emphasized. The safe limit of acceleration seems to be of the order of twenty times.

SURFACE TEXTURE: ITS INFLUENCE ON ORGANIC FINISHING

by Dr. Walter Stein, Joseph Lucas Limited, and D. H. Lloyd, Fisher & Ludlow Limited, *England*

In automobile and appliance industries where nearly half the organic finishing material is used on decorative surfaces to improve the surface texture of the metal, rejects for surface irregu-

Dr. E. Bertorelle

A. A. B. Harvey

Dr. Walter Stein

D. H. Lloyd

Chih-Yeu Lu

Dr. A. Mohrnheim

Dr. M. H. Jones

J. Zajdowski

Robert F. Ayres

L. E. Samuels

Dr. Henry Brown

Max Weinberg

larities may be attributed either to a bad metal surface, or to the failure of the organic finisher to level it. Lack of "balance" between sections of the plant is the principal factor in heavy surface reject rates. Surface irregularities are divided into three amplitude groups and the probable trend of future development is discussed. The importance of close cooperation between plant designers, paint technologists and production engineers is emphasized.

2:30 p.m. **Educational Session** ..... **Artillery Armory**

SESSION D

Chairman—William M. Phillips, *United States*

THE INFLUENCE OF THE PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIS METAL ON ELECTROPLATING—FERROUS METAL CONDITIONS AFFECTING THE DURABILITY OF WATTS NICKEL DEPOSITS

by Dr. Maurice H. Jones, Chih-Yeu Lu, Dr. A. F. Mohrnheim and J. Zajdowski, Ontario Research Foundation, *Canada*

As part of the work of AES Research Project No. 14, a study has been made of a number of the factors associated with ferrous bases that may influence the performance of Watts nickel deposits. These include the metallurgical history, the non-metallic inclusion contents, the surface condition resulting from different types of mechanical polishing and the deformation caused by stretching. The relative importance of various conditions and treatments on durability towards accelerated corrosion tests has been evaluated in statistically designed experiments.

THE NATURE OF MECHANICALLY POLISHED SURFACES

by L. E. Samuels, Defense Standards Laboratories, *Australia*

It is usually assumed that mechanical polishing of metal occurs by a mechanism of surface flow. Evidence is reviewed which indicates that flow either by a mechanism of the type proposed by Beilby or by one of gross plastic deformation does not occur in normal practice. Polishing appears to occur primarily by a cutting mechanism. A deformed layer is produced on the surface due to the cutting. Its nature and its possible influence on covering electrodeposits are discussed.

OUTDOOR CORROSION RESULTS WITH CHROMIUM-NICKEL-CHROMIUM PLATE

by Dr. Henry Brown and Max Weinberg, The Udylite Research Corporation, *United States*

The excellent protection obtained in two and three years of outdoor exposure in an industrial atmosphere for the plating sequences of Cr-Ni-Cr plate, Cu-Cr-Ni-Cr plate and Ni-Cr-Ni-Cr plate on steel and zinc die-cast are detailed, together with the plating procedures used. These results are compared with Cu-Ni-Cr and Ni-Cr plate of various thicknesses. The types of corrosion pits encountered with all these composite coatings are illustrated and compared. The systems with the final sequence of Cr-Ni-Cr, in which the high temperature type of chromium plate, about 0.05 mil, was used underneath the nickel plate, demonstrated outstanding protection against corrosion.

IMPROVED CORROSION RESISTANCE FOR ELECTROPLATED DIE CASTINGS

by Dr. Charles L. Faust, Hugh R. Miller and William H. Safranek, Battelle Memorial Institute, *United States*

A research program sponsored by the American Zinc Institute included a study of many procedures for improving the corrosion resistance of electroplated die castings. Several plating systems showed good corrosion performance in outdoor weathering and accelerated corrosion studies on more than 500 panels and parts. The procedures deemed most practical for commercial production and which are capable of furnishing excellent corrosion protection include: (1) copper, duplex nickel and chromium, and (2) copper, bright nickel, and bright, crackfree chromium. Both systems are practiced commercially. The information in this paper justifies an expansion in production facilities for plating duplex nickel and bright, crackfree chromium, with the objective of improving the performance of die cast automobile hardware.

Dr. T. L. Rama Char

Dr. Charles L. Faust

Hugh R. Miller

William H. Safranek

Frank L. La Que

Donald M. Bigge

Dr. J. Edwards

Cleveland F. Nixon

Robert A. Boller

H. W. Howard

Myron Perez

Dr. R. C. Gibson

WEDNESDAY, JUNE, 17

9:00 a.m. Educational Session ..... Grand Ballroom

SESSION E

Chairman—Clarence H. Sample, The International Nickel Co., Inc., *United States*

CORROSION TESTING OF ELECTRODEPOSITED COATINGS

by F. L. LaQue, The International Nickel Co., Inc., *United States*

Corrosion testing is vital to the success of plating. Tests are needed for three principal purposes: (1) To observe the performance of coatings under natural conditions of exposure properly related to actual use. (2) To observe the performance of coatings under conditions that will permit proper appraisal of quality in a time short enough to be useful for inspection and to be helpful in expediting research leading to improved quality. (3) As a tool of research having advantages beyond reduction of the time required to secure useful results. This paper discusses the basic requirements and possible limitations of tests being used or proposed for the purposes mentioned. Appropriate data are included to support the points discussed.

EXPERIENCE WITH THE USE OF THE CORRODKOTE TEST

by Donald M. Bigge, Chrysler Corporation, *United States*

The Corrodkote Test has proved to be valuable both as a product acceptance test as well as a dependable means of evaluating research on electroplated copper, nickel and chromium coatings. Rather excellent correlation has been established between service exposure and Corrodkote Test results. Pertinent information is illustrated with photographs and charts.

SULFUR DIOXIDE ACCELERATED CORROSION TEST—TESTING CONDITIONS AND EQUIPMENT

by Dr. J. Edwards, British Non-Ferrous Metals Research Association, *England*

The effect of varying the temperature of the test atmosphere has been investigated; the results indicate that the cabinet in which sulfur dioxide accelerated corrosion tests are made should be thermostatically controlled. Full details are given of the design of a suitable cabinet which will enable temperature, relative humidity and sulfur dioxide concentration to be kept within the recommended limits. A brief discussion is included of the scope and application of this form of accelerated corrosion test.

THE COPPER CHLORIDE MODIFICATION OF THE ACETIC ACID SALT SPRAY TEST

by Cleveland F. Nixon, General Motors Corporation, *United States*

Following a brief discussion of the development of the CASS Test and of the presently recommended operating procedure, data and illustrations are presented to support the view that correlation between test results and out-of-door performance is good enough to make the test useful for both acceptance testing and for evaluating development effort to improve the durability of decorative plating and other finishes. Progress towards better understanding of what happens in the test chamber is reported, the object of this continued work being to further improve correlation of test results between laboratories and to achieve practical reliability in predicting out-of-door performance over several years of service.

9:00 a.m. Educational Session ..... Michigan Room

SESSION F

Chairman—Ralph D. Wysong, Studebaker-Packard Corporation, *United States*

WATER-SOLUBLE COATINGS FOR METAL FINISHING

by Robert A. Boller, Archer-Daniels-Midland Co., *United States*

Water-soluble resins can provide paint formulations and performance characteristics similar to conventional solvent-thinned alkyds, but eliminate the usual fire hazards associated with solvent systems. These water-thinned vehicles exist as clear solutions and remain in one phase

Dr. A. M. Max

M. L. Whitehurst

Dr. Erich Laue

C. Williams

R. A. F. Hammond

U. F. Marx

Dr. F. A. Lowenheim

William H. Rowan

A. W. Brace

M. S. Hunter

P. F. Towner

when diluted with water. Resins of this type offer the following features: simplicity of paint formulation, ease of pigment dispersion, film continuity, high pigment binding and gloss, mechanical stability and film conversion. Spray application appears to be the most desirable method of coating. Performance characteristics illustrated by photos, tables and graphs provide evidence that water-soluble resins can produce both primers and enamels for metal which compare favorably to quality solvent-thinned coatings in use today.

EPOXY RESIN COATINGS FOR THE ELECTROPLATING INDUSTRIES

by H. W. Howard, Shell Chemical Corporation, *United States*

Their superior adhesion, flexibility, toughness and resistance to chemical attack and elevated temperature make the Epoxy resin coatings of special interest in the electroplating industry. Uses suggested are: clear films over decorative finishes such as silver, brass, bronze, etc.; stop-off coatings; protection of equipment and facilities in the plating room; lining plating tanks and coating racks. Resistance to chemical attack is so high that a stop-off coating applied before plating may, in some instances, be left on as part of the final finish.

VINYL DISPERSIONS: THEIR USE IN METAL FINISHING

by Myron Perez, Metal & Thermit Corporation, *United States*

The use of vinyl dispersions as coatings for metals is discussed, together with basic application techniques and equipment. Principal chemical and physical properties and methods of obtaining them by careful formulation are described. Recently vinyl dispersions, usually spray-applied as smooth, textured or "spattered" coatings have progressed into the decorative area. Some of the newer dispersions, at present either in limited use, or still in the development stage are presented together with suggested fields of usage.

THURSDAY, JUNE 18

9:00 a.m. Educational Session ..... **Grand Ballroom**

SESSION G

Chairman—Dr. S. Wernick, Institute of Metal Finishing, *England*

THE EFFECT OF FLOW RATE AND CURRENT DENSITY ON THE ELECTROLYTIC REMOVAL RATE OF IRON AND COPPER FROM A WATTS NICKEL SOLUTION

by Dr. Abraham M. Max and M. L. Whitehurst, RCA Record Division, Radio Corporation of America, *United States*

In a diffusion controlled process, the amount of a component remaining with increase in time can be shown to follow a logarithmic decay curve. If the complicating factor of cathode surface roughening is avoided, the electrolytic removal of copper from a Watts nickel solution is shown to follow such a relationship. The removal rate coefficient has been found to increase materially with flow rate from six to fifty feet per minute. Iron removal is complicated by (a) a possible threshold below which iron does not deposit from a nickel solution and (b) precipitation of ferric hydroxide on surfaces if the *p*H is not sufficiently low to keep the ferric ion in solution. The latter is related to the solubility product of ferric hydroxide. Beyond the threshold, the effect of increasing flow rate appears to increase electrolytic removal rate of iron.

CHROMIUM IN CYANIDE SOLUTIONS AND ITS REMOVAL

by Dr. Erich Laue, MacDermid Incorporated, *United States*

The effects of chromate impurities in cyanide copper plating solutions, and several unsuccessful or undesirable removal processes are discussed. A new method for reducing hexavalent chromium and precipitating the resultant trivalent chromium with alizarin is described. The method may be applied to other alkaline plating solutions, and a number of precipitating agents of the hydroxy anthraquinone type may be used. A simple practical procedure to detect chromium in cyanide copper solutions and to test the effectiveness of the method is illustrated.

D. L. Robinson

P. Lelong

J. Hérenguel

H. D. Hughes

Dr. Richard Lattey

Dr. P. A. Jacquet

Dr. E. B. Saubestre

Robert Mondon

Dr. H. Spahn

A. W. Wallbank

Gaetan Abadie

Georges Vidal

THE EFFECT OF SHOT-PEENING AND OF GRINDING ON THE FATIGUE STRENGTH OF CHROMIUM PLATED HIGH STRENGTH STEEL

by R. A. F. Hammond and C. Williams, Armament Research and Development Establishment, Ministry of Supply, *England*

The effect of shot-peening prior to chromium plating on the fatigue strength of two steels of 180,000 psi and 224,000 psi tensile strength respectively (and of surface rolling with the weaker steel) has been determined by rotating-bend tests. Various intensities of peening and of rolling have been studied, and the fatigue strengths of the plated steels were shown to increase progressively with the intensity of the surface treatment, ultimately attaining the unplated values. The increase in surface roughness resulting from peening at various intensities was measured for both steels and the effect on the fatigue limit of grinding, before or after chromium plating, to restore a good machine finish was then determined. The effect of baking at various stages was also investigated.

SOME ASPECTS OF THE CORROSION OF DECORATIVE PLATED COATINGS

by Dr. Frederick A. Lowenheim and William H. Rowan, Metal & Thermit Corporation, *United States*

The vital importance of improved corrosion performance of decorative-protective plated coatings is emphasized and some current efforts toward this end are reviewed. The value of statistical design in testing is illustrated. Effects of increasing thickness of copper, nickel, and chromium coatings are described. Possible improvement from the use of other coatings, such as 10 per cent tin-bronze as a substitute for copper under nickel, as well as tin-nickel alloy deposit, alone and in combination with other coatings is discussed.

2:30 p.m. Educational Session ..... Grand Ballroom

SESSION H

Chairman—Ezra A. Blount, Products Finishing Magazine, *United States*

EUROPEAN BRIGHT ANODIZING PRACTICE

by A. W. Brace, Aluminium Laboratories Limited, *England*

The response to bright anodizing is dependent on the composition and metallurgical structure of the aluminum, and these factors are briefly discussed. Both chemical and electrochemical brightening techniques are discussed. The influence of anodizing and sealing conditions on resistance to atmospheric corrosion is described, and methods for testing anodic coatings are summarized.

HYDRATION OF ANODIC OXIDE FILMS

by M. S. Hunter, P. F. Towner and D. L. Robinson, Aluminum Company of America, *United States*

The mechanism of hydration of anodically formed aluminum oxide films during sealing in boiling water is discussed and the progress of hydration is demonstrated by electrical measurements and illustrated by electron micrographs. Sealing of commercial anodic coatings is considered in the light of evidence indicating that the usual practices employed do not result in complete filling of the pores in the coating. The effects of various factors in accelerating and retarding the rate of hydration are also discussed.

ANODIZING PROCESSES FOR THE PRODUCTION OF VERY THICK ALUMINA FILMS

by P. Lelong, Centre de Recherches d'Antony; R. Segond, Société Procol; and J. Hérenguel, Société des Tréfileries et Laminoirs du Havre, *France*

Numerous anodic oxidation processes have been developed for forming thick and hard alumina films on aluminum alloys. Most of these processes make use of electrolytes at very low temperature. Processes developed in France make possible the formulation of thick hard films at or above temperatures normally used. The electrolytes are made from acid salts and organic acids. Two of these solutions are described in detail; one a solution of sodium bisulfate and citric acid, and the other, a solution of oxalic and formic acids. These processes permit the formation of films several hundred microns thick (24 microns-1 mil) at unusually high current densities.

DEVELOPMENTS IN THE SURFACE TREATMENT OF ALUMINUM—PROCESSES AND MATERIALS

by Dr. Richard Lattey, Vereinigte Aluminum Werke Research Center, *Germany*

Industry requirements for bright anodized aluminum have stimulated production of super-purity aluminum. This paper explains the necessity for anodic or chemical brightening prior to bright anodizing. The theory of anodic chemical brightening is discussed, and the role of passivating surface coatings and films therein is indicated; adnodizing is discussed in a similar manner. Specific processes for brightening and anodizing are ducsucced in some detail, as well as control methods. Mention is made of a new commercial aluminum alloy which is competing favorably with super-purity aluminum on many applications.

FRIDAY, JUNE 19

9:00 a.m. Educational Session ..... Grand Ballroom

SESSION I

Chairman—A. W. Wallbank, Ionic Plating Company Ltd., *England*

ELECTROCHEMICAL TECHNIQUES IN MODERN METALLOGRAPHY

by Dr. Pierre A. Jacquet, Technical Department of Naval Construction and Armaments, *France*

The value of metallography in modern metallurgy is widely recognized. The importance of electrochemistry in the transition of metallography from an art to a science, and in the x-ray and electronic examination of metal surfaces is discussed. A new advance, combining non-destructive "plug electropolishing" and an improved replica procedure is described. Electrolytic methods are reviewed, and techniques described for preparing surfaces for microscopic examination or for making replicas for optical and electronic micrographs. A number of photomicrographs, including a few showing copper, nickel and chromium coatings, illustrate results obtained with the techniques described.

THE PRESENT STATE OF ELECTROLYTIC POLISHING IN EUROPE

by Robert Mondon, Société Jacquet-Hispano Suiza, *France*

Electrolytic polishing, born in the laboratory about 30 years ago for the examination of metallographic specimens, has progressed steadily in this field, and has been helpful in studying the influence of surface distortion caused by machining and usual finishing methods on fundamental properties, such as friction and wear and resistance to fatigue and certain types of corrosion. The use of electrolytic polishing in the decorative field in Europe has been retarded by unavailability of suitable basis metals. Its widest industrial uses are non-decorative, such as deburring, improving corrosion resistance and smoothening metal surfaces.

ELECTROLESS COPPER PLATING

by Dr. Edward B. Saubestre, Enthone, Inc., *United States*

The process of electroless copper plating is discussed with particular reference to coating of plastics in the manufacture of printed circuits. The development work described may be subdivided into the following steps: (1) selection of a sensitizer, (2) selection of a reducing agent, and (3) selection of a copper solution. Discussion is also made of formula suitable for depositing thin copper mirrors and for depositing 1-2 mil copper coatings.

SOME CHEMICAL POLISHING PROCESSES—THEIR MECHANISM AND THEIR APPLICATION

by Dr. H. Spahn, Institut fur Werkstoffkunde, *Germany*

In the chemical polishing of copper and its zinc- and zinc-nickel-alloys, the dissolution rate is controlled by the kinetics of the formation of nitrous acid in the viscous layer surrounding the metal. The role of nitrous acid is discussed using data of electrochemical measurements, viscosity and water activity in the viscous layer. The mechanism of polishing zinc, aluminum and nickel is illustrated. Properties of chemically polished surfaces are discussed and compared with surfaces produced by electrolytic polishing. A short survey of control methods for chemical polishing solutions is given, and some commercial processes tabulated.

INFLUENCE OF VARIOUS SURFACE TREATMENTS ON THE RESISTANCE TO FATIGUE OF TWO HIGH STRENGTH ALUMINUM ALLOYS

by Gaetan Abadie, Societé Exploitation Materiels Hispano-Suiza, and Georges Vidal, National Office d'Etudes et de Recherches Aéronautiques, *France*

The two alloys studied are normally used in the production of large aircraft landing gear forgings. The surface treatments studied were chemical milling, electro-polishing, anodizing, acid etching and a proprietary chromate treatment. The fatigue tests were made by means of Schenk fatigue machines of the "Webi" type with 10^4 and 10^6 alternations at rupture.

9:00 a.m. Educational Session ..... Michigan Room

SESSION J

Chairman—A. A. B. Harvey, Sunbeam Anti-Corrosives Limited, *England*

THE EFFECT OF METAL PREPARATION ON THE PERFORMANCE OF WATER THINNED COATINGS

by R. A. Williams, Rinshed-Mason Company, *United States*

For this investigation, four different proprietary water thinned vehicles, two of the water soluble vehicle type and two of the emulsion type, were used. A petroleum solvent thinned primer was included as a control. Humidity salt spray and water immersion resistance as well as film hardness, gloss and flexibility were investigated. Seven different types of metal treatment were performed on steel panels prior to coating and their effects tabulated. All tests were carried out in quadruplicate.

Ralph A. Williams

W. H. McKnight

Dr. P. Baeyens

J. L. Melse

George E. Best

J. G. Hecker Jr.

John W. McGrew

R. V. Vanden Berg

Dr. Harold J. Read

Dr. T. J. Whalen

R. S. Modjeska

Simon P. Gary

VINYLS IN MODERN INDUSTRIAL COATINGS

by W. H. McKnight, Union Carbide Plastics Company, *United States*

The principal types of vinyl materials discussed are vinyl solution coatings, organosols, and plastisols, all of which are normally baked. Typical molecular structures, methods of manufacture, physical and chemical properties are discussed. Because adhesion is an important formulating problem, primers have received considerable attention. Formulating principles are discussed in detail. New applications for organosols and plastisols are appearing frequently, and a brief forecast of expected striking developments is presented.

PROTECTING SILVER AND COPPER AGAINST TARNISHING BY MEANS OF A CHROMATE PASSIVATING PROCESS

by Dr. P. Baeyens and J. L. Melse, N. V. Philips' Gloeilampenfabrieken, *Holland*

The paper describes the experimental work on which are based improvements in the method of obtaining protection of silver or copper by immersion in solutions of hexavalent chromium compounds. To obtain good passivation consistently, without interfering appreciably with the solderability of either silver or copper, certain metal-complexing agents are added to the hexavalent chromium solution so as to maintain a defined relationship between the *p*H value of the solution and the metal solution potential.

CHROMIC ACID ANODIZING CHARACTERISTICS OF WROUGHT ALUMINUM ALLOYS

by George E. Best, Solvay Process Division, Allied Chemical Corp.; J. G. Hecker Jr., Aluminum Company of America; John W. McGrew, The Martin Co.; and R. V. Vanden Berg, Aluminum Company of America, *United States*

Experimental preparation of chromic acid anodized coatings has been carried out with the following wrought aluminum alloys: 1100, 2024, 3003, 5052, 5056, 6061, 7075, Alclad 2014 and Alclad 7075. Operating variables of voltage, time, bath *p*H and temperature were explored above and below the chosen standard of 40 v–30 min.—*p*H 0.5—95F. Measurements were made of current density, coating weight, coating thickness, dielectric strength, and salt spray resistance, with calculations of coating weight per ampere-minute, electrical and coating efficiencies.

2:30 p.m. **Educational Session**.....**Artillery Armory**

SESSION K

Chairman—Dr. Abner Brenner, National Bureau of Standards, *United States*

BARREL PLATING WITH SPECIAL CONSIDERATION TO PROTECTION OF THREAD DIAMETERS

by A. W. Wallbank, Ionic Plating Company Ltd., *England*

The importance of batch size in selection of barrel plating equipment and rival methods of constant weight and constant area in barrel loading are discussed, as well as equipment and solutions for barrel chromium plating. The effect of deposit variation in the load is discussed and reasons given for the adoption of Batch Average as the criterion of quality. A method for calculation of probability of interference with various deposits and thread diameters is derived and explained. Methods are suggested for protecting thread diameters when the standard allowance is insufficient for the required deposit.

DUCTILITY IN PLATED COATINGS

by Dr. Harold J. Read, Pennsylvania State University, and Dr. Thomas J. Whalen, Ford Motor Company, *United States*

Ductility of plated coatings is of importance as a factor in corrosion, and in forming pre-plated strip. Because plated coatings are thin, useful data can be obtained only in a test which is convenient and useful for specimens which would usually be described as brittle foils. The Jovignot hydraulic bulge test has been adapted to this problem, and data agree well with those obtained with the traditional tensile test, which is difficult to use on brittle foils. New convenient self-contained rapid equipment is described which can be operated by unskilled personnel. "Significant strain" is explained and the method of obtaining strain data from the hydraulic bulge test is described. Effects of bath composition and plating conditions on the ductility of some plated coatings are shown.

GRAIN SIZE CONTROL IN ELECTROFORMING

by H. Denis Hughes, Metachemical Processes Limited, *England*

ELECTRODEPOSITS AS RESISTS IN SELECTIVE HEAT TREATING

by R. Scott Modjeska and Simon P. Gary, Scientific Control Laboratories, Inc., *United States*

Mild steel (SAE-1010) rods partially masked plated with copper, tin-bronze, tin, silver and nickel are carburized or nitrided. Efficiencies as resists are compared. Micro studies of the electrodeposits before and after heat treating are compared in an attempt to learn mechanism of resist. Included are formulae and operating conditions for plating baths employed and data on heat treating conditions.

WHILE ATTENDING AES'S
GOLDEN JUBILEE CONVENTION,

YOU ARE MOST
CORDIALLY INVITED
TO
VISIT THE AES'S
FIFTIETH ANNIVERSARY
LOUNGE
AT ITS
INDUSTRIAL FINISHING
EXPOSITION

ARTILLERY ARMORY,
JUNE 15–19, 1959

AND VIEW ITS
AES, PLATING MAGAZINE AND
RESEARCH PROGRAM EXHIBITS

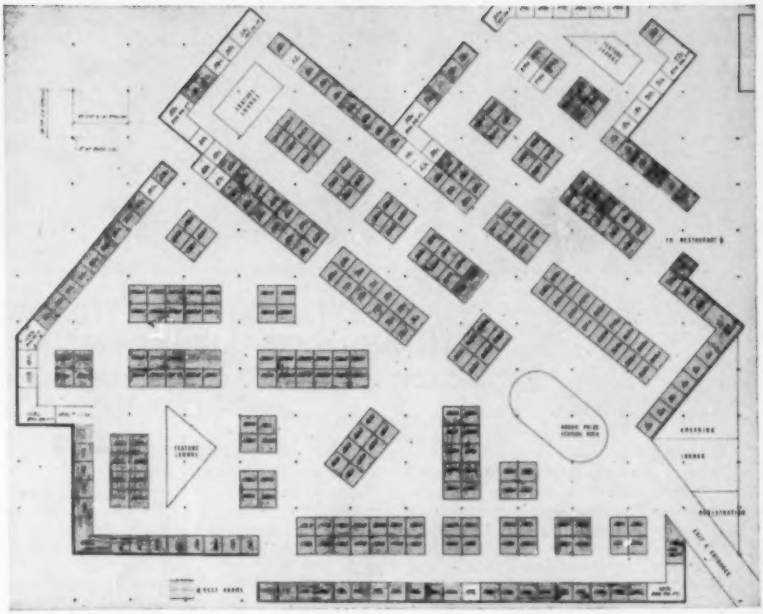
AES BOARD AND COMMITTEE MEETINGS AT GOLDEN JUBILEE CONVENTION

SUNDAY, JUNE 14		**Parlor**	**Presiding**
9 a.m.	Executive Board	B	Herberth E. Head
4 p.m.	Credentials Committee	B	Cleveland F. Nixon
4 p.m.	Scientific Achievement Award Committee	F	Dr. Abner Brenner
MONDAY, JUNE 15			
12 p.m.	Branch Secretaries	English	John P. Nichols
3 p.m.	Editorial Board	E	John P. Nichols
4:30 p.m.	Order of Past Presidents	F	Samuel S. Johnson
TUESDAY, JUNE 16			
9 a.m.	Research Committee	F	Dr. Russel E. Harr
9 a.m.	Educational Committee	E	Dr. Dodd S. Carr
12 p.m.	Branch Librarians	English	Ralph D. Wysong
WEDNESDAY, JUNE 17			
9 a.m.	Membership Committee	F	Manuel Ben
9 a.m.	Public Relations Committee	English	Frank Tirendi
9 a.m.	Midwest Regional Council	B	Leslie L. Divoley
1 p.m.	Publications Committee	B	Dr. Samuel Heiman
FRIDAY, JUNE 19			
9 a.m.	Executive Board	B	New President

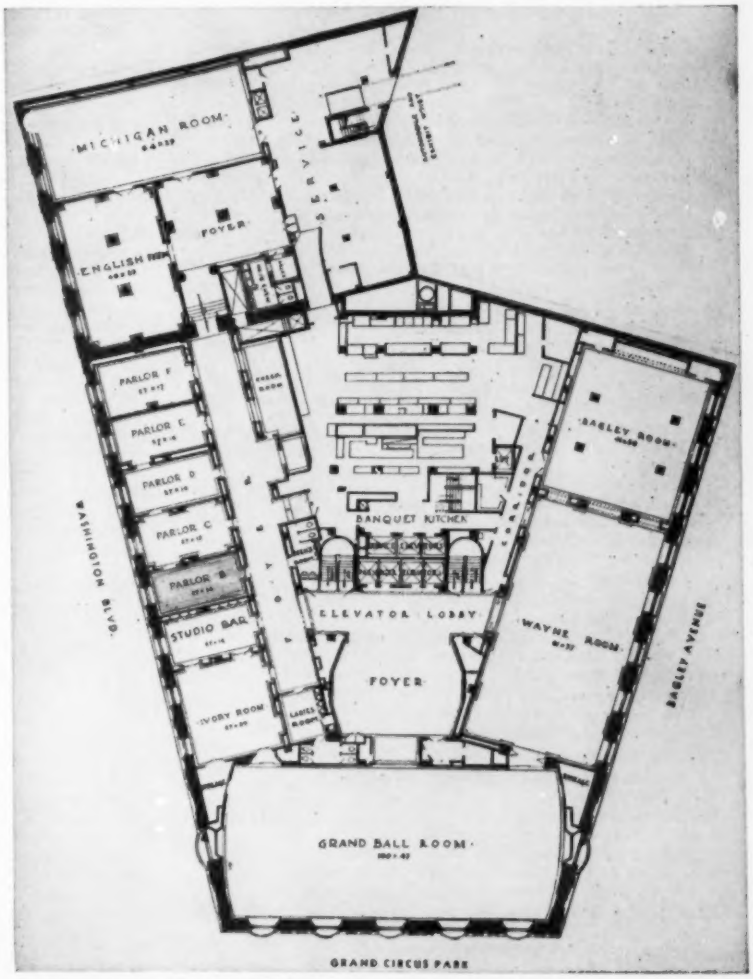
LOS ANGELES CONVENTION DATES CHANGED

At its meeting held in Washington, D.C., Friday, April 10, 1959, the Executive Board approved the request of the Los Angeles Branch Convention Committee and altered the dates of AES's 1960 National Convention from July 10–14, 1960 to July 24–28, 1960.

The modification was made necessary by the fact of the recent selection of Los Angeles as National Convention site of the Democratic Party to occur during the July 10–14 week. By making the change as suggested, the Board concurred with the view of the Los Angeles Branch that AES "... Conventioneers will be able to enjoy their visit to the West Coast a little better... you can well imagine how crowded this town is going to be with 20,000 politicians using up all the available hotel rooms, taxi cabs, buses, etc...."



Artillery Armory floor plan. Darkened areas indicate exhibition space reserved as of April 23, 1959.



Ballroom floor of the Statler-Hilton Hotel. Shaded area is AES Headquarters Room.

EXHIBITORS AT THE AES FIFTH INDUSTRIAL FINISHING EXPOSITION

DETROIT ARTILLERY ARMORY, OAK PARK, MICHIGAN

JUNE 16-19, 1959

Exhibitor	Booth No.
Abbey Process Automation, Inc. 37-01 48th Avenue, Long Island City 1, N. Y. Automatic barrel plating, rack anodizing systems	316-326
Abrado Finish Corp. 1750 Elizabeth, N. W., Grand Rapids 4, Mich. Barrel Finishing Equipment.	34
Acme Manufacturing Co. 1400 E. Nine Mile Road, Ferndale, Mich. Semi-automatic machines and small flat stock polishing machines.	270-272
Alchemize Corp. Congress Expressway at 621 South Kolmar Ave., Chicago 24, Ill. Chemical polishing supplies.	276
Allied Industrial Products, Inc. 620 No. Michigan Ave., Chicago 11, Ill. Ajax bias buff.	62
Allied Research Products, Inc. 4004 Monument St., Baltimore, Maryland. Rectifiers, automatic loaders and processes.	176-179
American Air Filter Co., Inc. Central Ave. at 2nd St., Louisville, Kentucky. Dust collectors, acid mist, fume collectors.	129 & 130
American Buff Co. 2414 S. LaSalle St., Chicago 16, Ill. Buffing and polishing wheels, flexible abrasive wheels.	1-6
American Metal Climax, Inc. 21 E. 26th St., New York 10, N. Y. Copper anodes and related items.	230
American Optical Co., Instrument Division. Eggert & Sugar Roads, Buffalo 15, N. Y. Recording Electro-Polarizer.	296
American Smelting & Refining Co. 120 Broadway, New York 5, N. Y. & Divisions: **Enthone, Inc.** **Federated Metals** **Abbey Process Automation, Inc.** Anodes, brighteners, strippers, blackening compounds, preservatives, plating chemicals and equipment.	315-318 106-110 111 316-326
Automotive Rubber Co., Inc. 12550 Beech, Detroit, Mich. Air pollution control equipment, air scrubbers and washers, acid handling equipment, repair kits, plating racks, valves.	281-284
Baird Machine Co. 1700 Stratford Ave., Stratford, Conn. Barrel finishing machinery.	211
Beacon Supply Co. 110 Marginal Ave., Chelsea, Mass. Buffing wheels.	49
Belke Manufacturing Co. 947 N. Cicero Ave., Chicago, Ill. Plating barrels, rectifier, conveyorized automatic rack plating and automatic barrel equipment, corrosion proof equipment, racks.	147 & 150
Bias Buff & Wheel Div., Riegel Textile Corp. Conover, N. C. Buffs and related materials.	112
Bison Corp. 1935 Allen Ave., S. E., Canton, Ohio Buffing wheels and plating brighteners.	245 & 246
G. S. Blakeslee & Co. 1822 S. Laramie, Chicago 50, Ill. Degreasing and metal parts washing machines.	180-182
Branson Ultrasonic Corp. Stamford, Connecticut. Ultrasonic cleaning equipment.	31 & 32
Bruce Products Co. 500 N. West St., Howell, Michigan. Buffing & polishing compounds, drawing & forming compounds, grinding coolants, rust preventives.	155 & 156
Buckingham Products Co. 14100 Fullerton, Detroit 27, Michigan. Polishing and buffing compositions.	41 & 42
The Carborundum Co. Niagara Falls, N. Y. Barrel finishing machines, equipment, media and compounds.	161 & 162
Carmac Chemical Co. 1015 Peralta St., Pittsburgh 12, Pa. Chemicals.	19
Carpart Corp. 209 W. Exchange St., Owosso, Mich. Corrosion resistant hoods, tank liners, exhaust systems and fume collectors.	11
Casalbi Co., Globe Div. 540 Wayne St., Jackson, Mich. Barrel finishing equipment, supplies & accessories.	17
The Chemical Corp. 54 Waltham Ave., Springfield, Mass. Chromate conversion coatings.	50
Circo Equipment Co. 51 Terminal Ave., Clark, New Jersey. Ultrasonics, degreasers, steam cleaners.	120 & 121
Clementina, Ltd. 2277 Jerrold, San Francisco 24, Cal. Sand blasting equipment.	117
Cleveland Process Co. 1967 E. 57th, Cleveland 3, Ohio. Electric immersion heaters, quartz ovens.	206-209
Clifford-Rockwell Co. 19364 James Couzens Highway, Detroit 35, Mich. Metal finishing materials, belts, buffs, brushes, buffing compounds.	212 & 213
F. L. & J. C. Codman Co. Rockland, Mass. Buffing and polishing wheels.	20
Conversion Chemical Corp. 98 E. Main St., Rockville, Conn. Chromate conversion coatings and bright dips.	128
Corning Glass Works Corning, N. Y. Heat exchangers, industrial radiant heat.	74
Cowles Chemical Corp. 7016 Euclid, Cleveland 3, Ohio. Visual displays, cleaning processes.	37
Davies Supply & Mfg. Co. 4160 Meramec St., St. Louis 16, Mo. Plating racks and plastisol coatings.	249

Exhibitor	Booth No.
Dean Products, Inc., Thermo-Panel Div. 616 Franklin Ave., Brooklyn 38, N. Y. Thermopanel coil	151-154
Deering, Milliken & Co., Inc. 1045 Sixth Ave., New York, N. Y. Buffing fabrics.	12 & 13
Detrex Chemical Industries 14331 Woodrow Wilson, Detroit 32, Mich. Cleaning and coating compounds, solvents, degreaser and ultrasonic equipment.	63 & 64
The Diversey Corp. 1820 W. Roscoe St., Chicago 13, Ill. Anodizing pre-treatment and a new stainless steel bright dip process.	43 & 44
Dow Chemical Co. Midland, Michigan.	223 & 224
Du-Lite Chemical Corp. Middletown, Connecticut.	40
E. I. duPont de Nemours & Co. 1007 Market St., Wilmington 98, Delaware.	148 & 149
Du-Tone Chemical Co. 1208 Greenfield, Waukegan, Illinois. Electroplating processes and supplies.	124
Eaton Chemical & Dyestuff Co. 1490 Franklin St., Detroit 7, Mich. Chemicals, anodes, anodizing dyes, plating chemicals.	45
Electro-Glo Corp. 625 S. Kolmar Ave., Chicago, Ill. Electropolishing supplies.	273
Electronic Rectifiers, Inc. 2102 Spann Ave., Indianapolis 3, Indiana Dry contact rectifiers, rectifier power supplies, accessories.	99
Enthone, Inc. 442 Elm Street, New Haven, Conn. Metal strippers, blackening and alkaline derusting compounds, paint strippers, plating processes, buffing compound removers, tarnish and corrosion preventives.	106-110
Erie Engine & Manufacturing Co. 953 East 12th St., Erie, Pa.	171 & 172
Federated Metals Division of American Smelting & Refining Co. 120 Broadway, New York 5, N. Y. Anodes, brighteners, conversion coatings.	111
Fiftieth Anniversary Lounge. **American Electroplaters' Society** **Plating Magazine** **AES Research Program**	Lounge A
Finish Engineering Co., Inc. 1115 Cherry St., Erie, Pa. Tools and machines for decoration of castings and stampings.	228 & 229
Formax Manufacturing Corp. 3171 Bellevue, Detroit 7, Mich. Buffs and Buffing compounds.	231-234
G. S. Equipment Co. & G. S. Plastics Co. 15583 Brookpark Rd., Cleveland 35, Ohio. Plating barrels, corrosion test cabinets, corrosion resistant protective coatings & linings.	294 & 295
General American Transportation Co. 135 S. LaSalle St., Chicago 90, Ill. Chemical nickel alloy plating on various items.	252
Glo-Quartz Electric Heater Co. 4066 Erie St., Willoughby, Ohio. Electric immersion heaters, thermostats, infrared oven panels.	167 & 168
Grav-I-Flo Corp. 400 Norwood Ave., Sturgis, Mich. Mechanical finishing equipment.	143-146
Great Lakes Carbon Corp. 333 No. Michigan Ave., Chicago 1, Ill. Filter Aid	113
Hammond Machinery Builders, Inc. 1600 Douglas, Kalamazoo, Mich. Automatic polishing, buffing and deburring equipment.	261-266
Hanson-Van Winkle-Munning Co. 100 Church St., Matawan, N. J. Electroplating and polishing equipment and supplies.	299-314
Hardwood Line Manufacturing Co. 2022 N. California, Chicago 47, Ill. Lucite plating barrels	83
Harshaw Chemical Co. 1945 E. 97th St., Cleveland 6, Ohio Developments in electroplating	267-269
Haviland Products Co. 421 Ann St., N. W., Grand Rapids, Mich.	289
Heatbath Corp. Box 78, Springfield, Mass. Black oxide finishes, chromate coatings, aluminum brite dips, rust proofing compounds.	291 & 293
Heil Process Equipment Corp. 12901 Elmwood, Cleveland 11, Ohio. Corrosion resistant process equipment—lined tanks, acid proof heating equipment and corrosion-resistant ventilating equipment.	285 & 288
Hitchcock Publications—Grinding & Finishing Magazine. Wheaton, Ill. Publications.	92 & 93
R. O. Hull & Co., Inc. 1300 Parsons Ct., Rocky River 16, Ohio.	81 & 82
Industrial Filter & Pump Manufacturing Co. 5900 Ogden, Cicero, Ill. Pressure filters, ion exchangers, demineralizers, water softeners, centrifugal pumps, heat exchangers, waste treatment systems.	139-142
Industrial Instruments, Inc. 89 Commerce Road, Cedar Grove, N. J.	216
Industrial Plastic Fabricators, Inc. Endicott St., Norwood, Mass. PVC and fiberglass centrifugal fans, model PVC exhaust system, air washer.	135 & 136
International Nickel Co. 67 Wall St., New York 5, N. Y. Nickel plated material.	189 & 190
Ionic Electrostatic Corp. 111 Monroe St., Garfield, N. J. Electrostatic spray system.	277-280
Kocour Co. 4800 S. St. Louis, Chicago 32, Ill. Analytical set and instruments, buffing and finishing materials.	67 & 68
Kolene Corp. 12890 Westwood Ave., Detroit 23, Mich. Paint stripping, de-enameling.	114 & 115
Kraft Chemical Co. 917 W. 18th, Chicago 8, Ill. Chemical cyanides, raw materials.	9
La Salco, Inc. 2820 LaSalle, St. Louis 4, Missouri.	327 & 330
The Lea Manufacturing Co. 16 Cherry Ave., Waterbury 20, Conn. Industrial abrasive compositions and electroplating processes.	204
Lea-Ronal, Inc. 139-20 109th Ave., Jamaica 35, N. Y.	205
A. H. Losey Co. 110 S. Horton St., Jackson, Mich. Automatic polishing and buffing machines.	73
Lyon, Incorporated 13881 West Chicago, Detroit, Mich. Buffing wheels.	75
MacDermid, Inc. Waterbury 20, Conn. Compounds for cleaning copper plating, specialties, chromates.	185-188
Manpro Corp. 1360 Hilton Rd., Detroit 20, Mich. Vapor degreasers and metal driers.	131 & 132
McAleer Manufacturing Co. 101 S. Waterman, Detroit 17, Mich. Polishing and buffing compounds, bias-type cloth buffs, etc.	254 & 255
McGean Chemical Co. 1040 Midland Bldg., Cleveland 15, Ohio. Anodes and chemicals for metal finishing.	169 & 170
Merit Products, Inc. 3691 Lenawee Ave., Los Angeles 16, Cal. Specialized abrasive wheels and machinery.	173
Metal & Thermit Corp. Woodbridge Rd., Rahway, N. J. Plating materials and equipment.	199-203
Metal Finishing Magazine 381 Broadway, Westwood, N. J. Historical Exhibit, dating from 1903	Lounge B

Exhibitor	Booth No.
Michigan Buff Co., Inc. 3503 Gaylord, Detroit 12, Mich. Buffs, polishing wheels and abrasives.	79 & 80
Michigan Chrome & Chemical Co. 8615 Grinnel, Detroit 13, Mich. Rack coatings, stop-off materials, organic coatings.	16
Minnesota Mining & Manufacturing Co. 900 Bush Ave., St. Paul, Minn. Barreling finishing media and compounds.	38 & 39
Murray-Way Corp. Box 180, Birmingham, Mich. Polishing and buffing equipment.	96-98
NRC Equipment Corp. 160 Charlemont St., Newton 61, Mass. Vacuum metallizing equipment and samples of metallized parts.	57 & 58
Geo. L. Nankervis Co. 15300 Fullerton Ave., Detroit 27, Mich. Waste disposal unit.	51
National Association of Metal Finishers 60 Bently Rd., Cedar Grove, N. J. Association Activities.	138
National Carbon Co., Div. of Union Carbide Corp. 535 Fifth Ave., New York 17, N. Y. Impervious graphite including heat exchangers, pumps, pipes and fittings.	84
New Holland Machine Co. 723 North Prince St., Lancaster, Pa. Centrifugal dryers.	125
Nordson Corp. Jackson St., Amherst, Ohio. Airless spray painting equipment.	89
Oakite Products, Inc. 19 Rector St., New York 6, N. Y. Materials and methods for metal cleaning, surface preparation and electro-cleaning prior to plating and finishing.	72 & 73
Pennsalt Chemicals Corp. 3 Penn Center Plaza, Philadelphia 2, Pa. Product literature.	7
Perma-Line Rubber Products Corp. 1755 No. Winnebago Ave., Chicago 47, Ill. Tank linings, tool kit for repairing PVC tank linings.	15
Phillips Manufacturing Co., Inc. 3475 W. Touhy Ave., Chicago, Ill. Degreasers.	47 & 48
Platers Research Corp. 61 East 4th St., New York 3, N. Y. Metal cleaners, brighteners, additive agents and other plating specialties.	247
Plating Magazine 445 Broad St., Newark, N. J. Odyssey of a PLATING MAGAZINE issue.	50th Anniversary Lounge A
Pressure Blast Manufacturing Co., Inc. 27 Pleasant St., Manchester, Conn. Wet blasting equipment.	53
Productive Equipment Corp. 2926 W. Lake St., Chicago 12, Ill. Deburring and burnishing equipment.	85 & 86
Products Finishing Magazine 431 Main St., Cincinnati 2, Ohio. Plating equipment of "yesterday."	Lounge C
Rampe Manufacturing Co. 14915 Woodworth Ave., Cleveland 10, Ohio. Precision barrel finishing equipment, tumbling barrels.	69
Ransburg Electro-Coating Corp. 1234 Barth Ave., Indianapolis 7, Ind. Electro-static hand gun.	54
Rapid Electric Co. 2881 Middletown Rd., Bronx 61, N. Y. Power rectifiers.	76 & 77
Republic Lead Equipment Co. 7930 Jones Road, Cleveland, Ohio Lead anodes	297
Reynolds Metals Co. 6601 W. Broad St., Richmond 18, Va.	133 & 134
Schaffner Manufacturing Corp. Schaffner Bldg., Emsworth, Pittsburgh, Pa. Buffs, buffing and polishing wheels, compounds.	183 & 184
Sel-Rex Corp. 75 River Road, Nutley, N. J. Precious metals plating processes, rectifiers, fillers.	235-238
Service-Rack Division of Servi-Sure Mfg. Co. 131 No. Green St., Chicago 7, Ill. Anodizing racks, electropolishing racks.	70
Sethco Manufacturing Corp. 2284 Babylon Turnpike, Merrick, L. I., N. Y. Filter pump units.	65
J. J. Siefen Co. 5657 Lauderdale, Detroit 9, Mich. Liquid spraying equipment.	250 & 251
Siefen Compounds, Inc. 14325 Wisconsin, Detroit 38, Mich. Spray equipment, liquid buffing compounds.	23
Sifco Metachemical, Inc. 935 E. 63rd St., Cleveland 3, Ohio. Selective plating equipment, micrograin nickel electroforms.	122 & 123
Solventol Chemical Products, Inc. 15841 Second Ave., Detroit, Mich. Metal cleaning products.	174 & 175
Sparkler Manufacturing Co. Mundelein, Ill. Filtration equipment.	286 & 287
Standard Plating Rack Co. 1925 No. Paulina, Chicago, Ill. Plating racks and accessories.	52
F. B. Stevens Co. 1800 18th St., Detroit, Mich. Metal finishing equipment, buffing and polishing compositions.	191-194
F. J. Stokes Corp. 5500 Tabor Road, Philadelphia 20, Pa. Vacuum metallizing equipment.	94 & 95
The Stutz Company 4450 W. Carroll Ave., Chicago 24, Ill. Mechanical plating equipment.	257 & 260
Techline Division of Wheelabrator Corp. 2400 Avenue V, Vicksburg, Mich. Barrel finishing and wet blasting equipment.	118 & 119
Technic, Inc. 39 Snow St., Providence, R. I. Examples of precious metal electroplating.	217
Ther Electric & Machine Works 17 S. Jefferson, Chicago 6, Ill. Rectifiers.	258 & 259
Tranter Manufacturing, Inc. 735 E. Hazel St., Lansing 9, Mich. Equipment shown in cut-away tank applications.	214 & 215
H. O. Trerice Co. 1420 W. Lafayette, Detroit, Mich.	253 & 256
Turco Products, Inc. Terminal Annex 2649, Los Angeles 54, Calif. Phosphate coatings, aluminum conversion coatings, magnesium coatings, rust remover.	226 & 227
Udylite Corp. Detroit 11, Mich. Plating equipment and supplies.	239-244
Unit Process Assembles, Inc. 61 East 4th St., New York 3, N. Y. Non-destructive plating thickness tester and periodic reverse units for plating, alkaline derusting and descaling.	248
U. S. Stoneware Co. 220 W. Market St., Akron, Ohio. Corrosion resistant materials.	298
Universal Tumbling Supply Co. 18613 Lancashire, Detroit 13, Mich. Tumbling supplies, sample parts and castings.	46
Univertical Foundry & Machine Co. 14841 Meyers Rd., Detroit 27, Mich. Anodes, plating supplies.	163 & 164
Vanton Pump & Equipment Corp. 201 Sweetland Ave., Hillside, N. J. Plastic pumps, valves, other plating equipment.	210
A. T. Wagner Co. 2720 Wight St., Detroit 7, Mich. Supplies.	66
Wayne Products Corp. 114 Olive St., Palatine, Illinois. Filtration equipment for solutions air and water.	10
Westinghouse Electric Corp. Gateway #3, P. O. Box 868, Pittsburgh 30, Pa.	195-198
Wyandotte Chemicals Corp. Wyandotte, Mich. Chemical products for metal finishing, cleaners, paint removers, barrel finishing compounds, rust and scale removers.	157-159

CONVENTION CHAIRMEN

Mrs. Alice Pillsbury
Ladies

Manuel Ben
Exposition Vice Chairman

Wright W. Wilson
General Chairman

Howard J. McAleer
Exposition Chairman

Walter L. Pinner
Educational Chairman

Dr. R. B. Saltonstall
Co-Chairman
International Conference

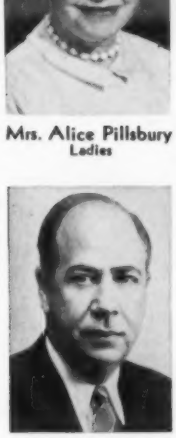
AMERICAN ELECTROPLATERS' SOCIETY CONGRATULATES AND THANKS

IN 1909, A HALF CENTURY AGO, sixty farseeing master platers of Knickerbocker, each dedicated to the development of plating and metal finishing, shared the vision of one Charles Henry Proctor, created the National Electro-Platers Association of the United States and Canada (NEPA) and centered its sights exclusively upon the advancement of electroplating, metal finishing and allied arts. NEPA was transformed into today's American Electroplaters' Society (AES) in 1913.

IN 1959, A HALF CENTURY LATER, that same AES is observing its FIFTIETH ANNIVERSARY. And planned climax of that observance is its Golden Jubilee Convention and Industrial Finishing Exposition, including its International Conference on Electrodeposition and Metal Finishing, being conducted in Detroit, Michigan, June 15–19, 1959, with the Detroit Branch, AES's largest chartered affiliate, as Host Branch.

TO THE STATESMEN, government officials and heads of the many Associations, Societies and publications, here and abroad, who have greeted it on its FIFTIETH ANNIVERSARY as well-wishers—to the civic leaders of Michigan and Detroit who are welcoming AES to their great State and City, June 15–19—to the officers and members of the Society's Detroit Branch who are hosting this vast AES enterprise—to the fine industrial companies that are exhibiting at the Exposition, advertising in PLATING MAGAZINE and providing hospitality at the Convention—to the leadership and personnel of AES's effective Convention, Exposition and International Conference Committees—to the executives and staff of Detroit's hotels that will house the Society's large numbers—to these plus the learned men from some ten nations of the world who will share their knowledge with AES's members attending the Educational Sessions, the Supreme Society, the Executive Board, National Headquarters and PLATING MAGAZINE express a hearty "thank you."

AND TO AES's attending membership, may your cup overflow with technical and scientific knowledge, and may you have much fellowship and fun in motordom's capital city, June 15–19, GOLDEN JUBILEE style.



Myron B. Diggin
Co-Chairman
International Conference

Dr. Walter R. Meyer
Co-Chairman
International Conference

William P. Katke Jr.
Hotel

Donald M. Bigge
Banquet

Donald C. Austin
Registration

John F. Seifen
Finance

Robert H. Dudley
Outing

A. J. Turner
Entertainment

James E. Fritts
Plant Visitation

Robert C. Trees
Publicity & Program

H. E. Nice
Hotel

Wilson McCormick
Hotel

Charles L. Southwick
Transportation

E. A. Blount
Treasurer

R. F. Ledford
1st Vice President

Earl W. Couch
President

F. P. Green
2nd Vice President

J. G. Carrique
3rd Vice President

METAL FINISHING SUPPLIERS' ASSOCIATION

HOTEL SHERATON-CADILLAC, DETROIT, MICHIGAN

A. P. Munning
Executive Secretary

MONDAY, JUNE 15

9 a.m.—Board of Trustees Meeting
12 noon—Luncheon and Annual Meeting ..... Crystal Ballroom
8–9 p.m.—Open House Party. Buffet Supper ..... Crystal, Grand & Founders Ballrooms
9–12 midnight—Open House Party. Dancing ..... Crystal, Grand & Founders Ballrooms

WEDNESDAY, JUNE 17

8:30 a.m.–12 noon—Golf Tournament ..... Pine Lake Country Club, Pontiac

M. M. Beckwith
Past President

NATIONAL ASSOCIATION OF METAL FINISHERS

HOTEL STATLER-HILTON, DETROIT, MICHIGAN

George W. Taylor
President

SUNDAY, JUNE 14

9:30 a.m.–5 p.m.—Registration ..... Foyer
9:30 a.m.–12 noon—Annual Membership Meeting ..... Bagley Room
1:30–5 p.m.—Board of Directors Meeting ..... Parlor F

MONDAY, JUNE 15

9:30 a.m.–5 p.m.—Registration ..... Foyer
9:30–11 a.m.—Local Secretaries and Representatives Meeting ..... Parlor F
1:30–5 p.m.—First Management Seminar ..... Bagley Room

TUESDAY, JUNE 16

9:30 a.m.–5:30 p.m.—Registration ..... Foyer
10 a.m.–12 noon—Second Management Seminar ..... Bagley Room
2–5 p.m.—Third Management Seminar ..... Bagley Room
6:15–8 p.m.—Registration ..... Bagley Room
7–8 p.m.—Reception ..... Bagley Room
8–9:30 p.m.—Banquet ..... Bagley Room

WEDNESDAY, JUNE 17

8:30-10:30 a.m.—Breakfast Meeting, NAMF and MFSA Directors
1:45-5:30 p.m.—Plant Visitation to Michigan Chrome and Chemical Co., United Platers, Inc. and Chemical Processing, Inc. Sponsored by Plating Institute of Michigan ..... Bus at 2 p.m. from Statler-Hilton

G. H. Friedt Jr.
General Chairman

John Palik Jr.
Past President

Sal Novelli
Ass't. Secretary
Treasurer

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Secretary-Treasurer

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Executive Secretary

AES NEWS

T. R. BOGGESS-AES THANKS HIM

Annually, for years, each National President, at the Second Business Session of the Supreme Society at the National Convention, terminal date of his administration, receives the traditional silver-plated gavel of his office. For as many years as that tradition has existed, the year's gavel has been plated and presented to the Society for that purpose by one man, namely Blue Ridge Branch President T. R. Boggess.

As AES celebrates its FIFTIETH ANNIVERSARY, its hearty thanks are extended to this stalwart of Vinton, Virginia, for this devoted service.

FOUNDER PROCTOR'S DAUGHTER AT AES HEADQUARTERS

AES recently had the pleasure of a visit at National Headquarters of Ruebe Proctor Preston, only daughter of the late Charles Henry Proctor, Founder-President of the National Electro-Platers Association of the United States and Canada (NEPA) and, therefore, father of AES. Wife of William O. Preston, the family makes its home in Madison, N. J.

Above, Mrs. Preston in company with some of the staff of AES/PLATING.

AES's 59TH BRANCH; GRANTED TEMPORARY CHARTER

With 17 Charter Members as a nucleus, an AES Branch has been formed in Phoenix, Arizona. And having complied with the requirements of the Society's Constitution it has been granted a Temporary Charter by the Executive Board effective April 10, 1959. If it successfully operates during its temporarily chartered period, the neophyte Branch will be eligible to apply for Permanent Charter after July 10, 1959.

William Griff of Motorola, Inc. is the Branch's first President and James E. Weaver of that same company is its Secretary-Treasurer.

As we go to press, the AES Executive Board has just temporarily chartered the Denver Branch, AES's Sixtieth Branch.

AN AES PRESIDENTIAL HONOR

Above the plaque presented to AES National Presidents at close of administration at the Supreme Society's Annual Meeting. President Head will receive his at the GOLDEN JUBILEE Annual Meeting, June 18, 1959.

MELBOURNE BRANCH WINS MEMBERSHIP EXPANSION COMPETITION

The Melbourne, Southeastern and Portland (Oregon) Branches prevailed in their respective divisions in the AES Annual Branch Membership Expansion Competition for the twelve-month period ending March 31, 1959. Accordingly, an award of $50 will be presented at the Golden Jubilee Convention in Detroit to each of the winning Branches for achieving the greatest membership expansion during that twelve-month period in their respective divisions.

For the twelve-month period ending March 31, 1959 (according to records on hand at National Headquarters on that day) the five leaders in the AES's respective divisions were:

BRANCH	Members Apr. 1, 1958	New Members	Net Change Membership (A)	Per Cent Change
FIRST DIVISION (126 members and Over)				
1. Melbourne	162	16	+17.0	+10.5
2. Newark	343	40	+25.0	+ 7.3
3. Toronto	182	12	+ 6.0	+ 3.3
4. Boston	175	14	+ 5.5	+ 3.1
5. Chicago	429	31	+11.5	+ 2.7
SECOND DIVISION (70-125 members)				
1. Southeastern	87	17	+12.5	+14.4
2. New Haven	103	11	+11.0	+10.7
3. Baltimore-Washington	97	11	+ 9.5	+ 9.8
4. Indianapolis	121	17	+ 7.5	+ 6.2
5. Dayton	118	10	+ 6.5	+ 5.5
THIRD DIVISION (10-69 members)				
1. Portland	23	5	+ 5.0	+21.7
2. Blue Ridge	26	4	+ 3.5	+13.5
3. Dallas-Ft. Worth	51	16	+ 6.0	+11.8
4. Hamilton	46	5	+ 5.0	+10.9
5. British Columbia	37	12	+ 4.0	+10.8

(A) After reconciling "New," "Reinstated" and "transferred In" members with "Resigned," "Suspended," "Died" and "Transferred Out" number. Net change is computed by rating "Transfers" at .5.

Robert M. Norton

RESEARCH COMMITTEE CHAIRMEN

(Origin through AES Golden Jubilee)

1923–1924	William Delage
1924–1925	R. L. Shepard
1925–1926	Frank J. Hanlon
1926–1929	R. J. O'Connor
1929–1933	Jacob Hay
1933–1936	William M. Phillips
1936–1938	George B. Hogaboom
1938–1941	Austin B. Wilson
1941–1943	Erwin Sohn
1944–1946	Carl E. Heussner
1946–1947	Ellsworth T. Candee
1947–1948	Dr. Richard M. Wick
1948–1949	Dr. Louis Weisberg
1949–1950	William M. Tucker
1950–1951	Dr. W. Andrew Wesley
1951–1952	G. M. Cole (Died Aug. '51) Dr. Donald Price
1952–1953	Dr. Donald Price
1953–1955	Dr. Earl J. Serfass
1955–1956	Leslie C. Borchert
1956–1957	Arthur H. DuRose
1957–1958	Robert A. Ehrhardt
1958–1959	Dr. Russel E. Harr

TO ALL BRANCH SECRETARIES

A complete list of all of your Branch Members in good standing as at June 30, 1959 is due in the hands of the National Executive Secretary by not later than July 15, 1959 as per Part II, Article V, Section 4 of the AES Bylaws. Your Branch will be billed for Per Capita Taxes for the fiscal year commencing July 1, 1959 and ending June 30, 1960 shortly thereafter based upon your filed list.

The tenure of your accredited Delegates/Alternates expires at the first Branch meeting following the June 18, 1959 Annual Meeting of the Supreme Society (or until their successors are duly elected and qualify). A list of your elected 1959-1960 Delegates/Alternates is due in the hands of the National Executive Secretary by not later than November 2, 1959 as per Part II, Article VII, Section 1 of the AES Bylaws.

CONVENTION NEWS STAFF BURNS MIDNIGHT OIL
Left to right: Howard A. Gauvain, Richard V. Morrison and Mildred Gleason

AES's QUARTER-CENTURY CONVENTION DAILY NEWSPAPER AND THOSE WHO CREATE IT

Each Convention morning, as regular and as anticipated as the New York Times' famed "bulldog edition," the tabloid "H-VW-M Official Convention News," has made its happy, newsy appearance so as to inform AES's large circle of members and their families and guests attending AES's Annual Conventions, concerning events, people, happenings and doings on the Convention scene. Including its GOLDEN JUBILEE CONVENTION service this June 15–19, the "News" has been on the Convention firing line for a full quarter century.

"H-VW-M," of course, stands for Hanson-Van Winkle-Manning Company, and that company, through O. S. Tyson & Company its advertising agency, has created and furnished that well-liked gazette since the Bridgeport Convention in 1935 as a service to AES and AES members, so many of whom are H-VW-M customers.

Publishing "Convention news fit to print" at newspaper pace means brains and brawn coordinated to deadline. Publishing "H-VW-M Official Convention News" therefore means a trained Tyson editorial, photographic and production team working at City Room tempo to produce the next morning's "News". And leading that fast-moving team on a "shirt sleeve" basis are Tyson Executive Vice President Richard V. Morrison and Editor Howard A. Gauvain, in close collaboration with Robert M. Norton, H-VW-M's Vice President responsible for such matters as Sales, Advertising and Public Relations.

To H-VW-M itself and to each of its tireless "News" publishers, AES extends hearty appreciation for the quarter-century contribution of that morning newspaper to the success of AES Conventions, and for the pleasure brought by it to the Society's members and guests over that long span, including the GOLDEN JUBILEE CONVENTION.

GOLDEN JUBILEE SPOTLIGHTED AT MEMORABLE MILWAUKEE BRANCH FETE

Exceeding in quality and attendance even its Annual Meetings of past years for which it is well-known throughout the Society, the Milwaukee Branch conducted a lauded GOLDEN JUBILEE event at the Schroeder Hotel, Milwaukee, April 25 under the general supervision of Branch President Frank Marshall.

The day started with an executive session of the Midwest Regional Council with General Chairman Leslie L. Diveley in the chair. Delegates from all six signatory Branches were in attendance, including AES First Vice President Ralph D. Wysong and National Executive Secretary John P. Nichols, present by invitation.

The noon-day reception was followed by Milwaukee's traditional large luncheon with Branch President Marshall serving as Toastmaster. Introduced were the Delegates of the Midwest Council and other distinguished guests. The audience then heard the remarks of AES First Vice President Wysong and Second Vice President Wesley, then the principal address by National Executive Secretary Nichols.

The well-attended educational session featured the talk on "Weathering Behavior of Nickel, Chrome, Nickel-Chrome Coatings" by Dr. Wesley of the International Nickel Co.; "The Role of Agitation in Electroplating" by Dr. Richard B. Saltonstall, technical director, The Udylite Corporation and "Emulsion Coatings for Industrial Application" by Alex Andreoni, technical director, The Glidden Company.

The evening's GOLDEN JUBILEE Banquet was among the lavish such events of AES's FIFTIETH ANNIVERSARY observance.

Responsible for the GOLDEN JUBILEE fine day in Milwaukee were Edward J. Weiss (Banquet Chairman); Walter Higgs, Ted Sobczynski, Lee Graves and Hilton M. Smith (Educational Committee; John Schneider and Steve Choren (Banquet Committee; Phil Ritzenthaler (Entertainment); Ed Ratterman (Luncheon); Gene Piellusch (Hotel); Herman Tessman (Publicity) and Glen Schwemer (Finance).

WATERBURY BRANCH HOST TO NEW ENGLAND REGIONAL MEETING

(1) Drs. Saubestre and Brenner spoke to standing room attendance at the Educational Session. (2) Left to right, Dr. Edward B. Saubestre and Dr. Abner Brenner, speakers; Edward Garland, general chairman; Frank Tirendi, Host Branch Committee; Michael Tamas, educational chairman. (3) Another view of the Educational Session. (4) The ladies played bingo in the afternoon. (5) Chairman Tamas opens the Educational Session. (6) General Chairman Garland extends greetings at the banquet. (7) A corner of the banquet room.

NEW ENGLAND'S GOLDEN JUBILEE MEETING CITED AS ONE OF REGION'S FINEST

With the Waterbury Branch as this year's host, five Branches, namely Bridgeport, Hartford, New Haven, Springfield and the host Branch collaborated to conduct the Twentieth Annual New England Regional Meeting at the Statler Hotel, Hartford, Saturday, April 18, 1959 as an outstanding GOLDEN JUBILEE event.

Educational Committee Chairman Michael Tamas's afternoon educational program attended by nearly 200 members and guests of the New England Regional Group, oldest of AES's five such regions, featured the address, "Electropolishing," by Dr. Edward B. Saubestre, Technical Director, Enthone, Inc., and the presentation by Dr. Abner Brenner of the National Bureau of Standards of highlights of his trip to Russia, illustrated by three-dimensional color slides.

The evening's banquet turned out some 700 members and guests who dined well then danced till early morning, with the GOLDEN JUBILEE ceremonial banner serving as background symbolic of the Society's half-century observance. The area's sources of supply combined to provide a cooperative well-patronized and well-received hospitality room before and after the banquet.

General Chairman Edward Garland of Waterbury was aided in general arrangements by a Waterbury Committee including Frank Tirendi and James Kennedy. Publicity Chairman Arnold Johnson of Hartford was assisted by Walter Dyber, Stanley Platoz and Armand Faucher. Educational Chairman Tamas's Committee included Allen Ferguson, Albin Jocis and Robert Parker of Bridgeport. Entertainment was spearheaded by New Haven reliables Chairman Charles Kuster, George O'Connor, Bernard Gaffney and Harry Taylor. Springfield was in charge of program advertising with Chairman Edward Koetsch, Charles Griffin Jr., Henry Heissfeld, Ellery Gibson and R. Girard carrying the burden.

AES Third Vice President Chester G. Borlet and National Executive Secretary John P. Nichols were among the Region's many guests that also included AES Past Presidents Arthur W. Logozzo, George Parsons Swift and Ellsworth T. Candee. Others present included Rodney Leeds, editor, and Ralph F. Scholbe, advertising manager of PLATING MAGAZINE; Ezra A. Blount, editor of Products Finishing; Peter Kovatis, Executive Secretary of the National Association of Metal Finishers and AES Law Committee Chairman Manson Glover. The printed program was hailed as one of the most distinctive of the GOLDEN JUBILEE.

HERMAN TESSMAN NAMED 1962 ANNUAL CONVENTION CHAIRMAN

Herman Tessman of the Milwaukee Branch was announced as General Chairman of the 1962 AES Annual Convention to be held in Milwaukee under the joint sponsorship of the six Branches composing the Midwest Regional Council. The announcement was made by Leslie L. Diveley, head of the Council at its meeting held at the Schroeder Hotel, Milwaukee, Saturday, April 25.

Eugene Roth of the St. Joseph Valley Branch and Leonard Weeg of Rockford were named as Assistant General Chairmen, and Joseph Andrus was announced as Host Branch Educational Committee Chairman. The Steering Committee is composed of Messrs. Tessman, Roth and Weeg plus Leslie Diveley and the Milwaukee Branch President.

Present at the Council's Milwaukee meeting were Clyde Kelly, R. Scott Modjeska, and Paul Glab (Chicago); Herman Tessman, Robert Stuernagel, Frank Marshall, Leslie L. Diveley and Philip Ritzenthaler (Milwaukee); Ralph D. Wysong, Eugene Roth and Ralph Brouwer (St. Joseph Valley); William Geissman and Harold Ellis (Rockford); A. P. Julius and William George (St. Louis) and L. O. Gilbert, A. W. Dennhardt and G. Parisho (Mississippi Valley).

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INTERSOCIETY NEWS

NEW ASTM DIVISION ON MATERIALS SCIENCES

A new Division on Materials Sciences will be organized by the American Society for Testing Materials to coordinate and intensify the development of knowledge of the fundamentals of materials. The new division, the first to be established by ASTM, will augment in depth and scope the society's long-time objectives of promoting knowledge of engineering materials and tapping new sources of knowledge for the society's extensive standardization activities. The division will concern itself with the collection, establishment, and publication of basic information essential in creating a better understanding of materials and their properties, and especially will help to answer "why" materials are what they are.

Since its inception in 1898, the society has published hundreds of technical papers and outstanding symposiums dealing with problems which are fundamental to our knowledge of why materials act the way they do. For example, a publication just being issued, "The Mechanism of Fatigue," deals almost entirely with the fundamentals of this phenomenon. The extensive nation-wide studies of corrosion-resisting properties of materials, on effect of temperature on metals, and many activities carried on in technical committees concerned with petroleum products, cement, soils, electrical contacts, and a host of other materials, contribute to fundamental knowledge. The studies also reveal areas where more basic information is needed.

This recommendation for a new division is one of several initiated by the ASTM Long-Range Planning Committee. Other developments have included an administrative committee on education in materials which has a program under way, and decisions to award certain Fellowships and "Grants-in-Aid" for materials study.

Actual development of the division has been entrusted to a group of four officers—President K. B. Woods, head, School of Civil Engineering, Purdue University; two ASTM vice presidents: F. L. LaQue, vice president and manager, Development and Research Division, The International Nickel Co., Inc., and A. Allan Bates, vice president of research and development, Portland Cement Association; and Executive Secretary Robert J. Painter.

PLANS FOR 1959 ISA CONFERENCE AND EXHIBIT

Partly completed plans for the 14th Annual Conference and Exhibit of the Instrument Society of America have been announced.

The conference and exhibit will be held in Chicago. The conference will run for six days, starting Sunday, Sept. 20. The exhibit will be open Sept. 21 through Sept. 25 on a schedule arranged to facilitate attendance at both functions.

During the week preceding the ISA conference, the International Federation of Automatic Control will be holding its General Assembly in Evanston, Ill., near Chicago. This, it was pointed out, will give IFAC delegates an opportunity to stay over for the ISA meeting. Harold Chestnut of the General Electric Company, Schenectady, N. Y. is president of the international federation.

On the basis of attendance in previous years, the 1959 conference and exhibit may be expected to draw as many as 30,000 persons. The newest products of manufacturers of instrumentation equipment will be displayed at the exhibit.

WEST COAST PLASTICS CONFERENCE

"Plastics in Packaging" is the theme of a technical conference planned for Nov. 19, 1959, by the Golden Gate Section of the Society of Plastics Engineers, Inc. Called a "RETEC", the one-day affair will bring together experts in both the plastics and packaging fields, at a site yet to be selected in the San Francisco Bay Area.

General Chairman of the event is Frank D. Allen, L. H. Butcher Co., San Francisco. Mr. Allen said that the program, now being organized, will feature papers by top men in their fields and demonstrations representing the newest developments of plastics in packaging.

PLASTICS ENGINEERS REGIONAL CONFERENCE IN AUTO CITY

For the fifth consecutive year, the Detroit Section of the Society of Plastics Engineers presents a Regional Technical Conference on Plastics for the Automotive Industry. The automotive capital of the world, Detroit, Michigan, will be the site of this one-day technical meeting. It will be held in the Sheraton-Cadillac Hotel on June 30, 1959.

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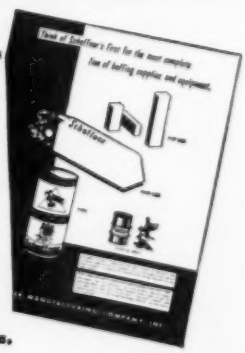

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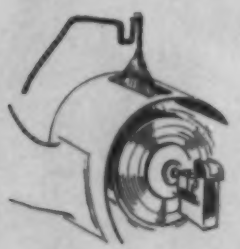

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LEA LIQUABRADE . . . clean-working, fast-cutting and mirror-finishing liquid buffing compound, providing in effect continuous operations and substantial economies in compositions and buffs; clean and safe, non-flammable, non-explosive; many abrasive types and grain sizes for all non-ferrous metals, steel, stainless alloys, and plastics.

LEAROK . . . compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations.

LEA GRIPMASTER . . . high bonding strength cement for polishing wheels and belts; used in setting up longer lasting polishing wheels and belts for both ferrous and non-ferrous metals.

AD-LEA-SIVE . . . glue-base adhesive for sizing, buffing and polishing wheels prior to application of Lea Compound, Leabrasive or other loose abrasives; available in bar form or bulk.

LEA LAPPING PASTE . . . micron size controlled abrasive paste for accurate and fine surface finishing.

LEA ANALYTICAL METHODS . . . plater's short cut methods for analyzing plating solutions.

LEA LIQUALUBE . . . water soluble liquid lubricant for polishing wheels and belts; can be sprayed or brushed on.

LEA LUBAR . . . bar form lubricant for polishing wheels and belts where glazing is not a problem.

cLEAn GRAIN LUBAR . . . special bar form lubricant to eliminate glazing on polishing wheels and belts.

LEA COLDSTRIP . . . a room temperature, non-toxic stripper for synthetic enamels; requires minimum ventilation; can be filtered for continuous use.

LEA SYNSTRIP . . . a fast working, non-corroding liquid stripper for enamel, lacquer and synthetic coatings; will not attack base metal or alloy; does not dissolve the coating but breaks the bond. Heating permits alkyd, epoxy, phenolic silicone and urea coatings to be stripped in seconds.

LEATARDENT . . . anti-stain dip emulsion; prevents staining and tarnishing of plated surfaces.

LEA PLASTI-BRADE . . . a flexible liquid abrasive polishing composition carrying the finer grit sizes.

LEA PLASTI-GLUE . . . a flexible liquid adhesive for setting up polishing wheels.

LEA KROMSAVERS . . . inert plastic rods and floating tubes . . . mist preventive for chrome and other plating solutions.

LEA LECTROMAG . . . portable electrical instrument for measuring the thickness of non-magnetic coatings on carbon steel and iron.

LEABRAMENT . . . greaseless, non-flammable, quick-drying, liquid abrasive for burring and polishing; can be sprayed or brushed on wheels.

LEA COPPER-GLO . . . . . tolerant to contaminants while consistently producing a high speed, buffable, bright plate.

LEA BUFF RAKE AND EVENER . . . a sturdy "two handy tools in one" for raking and evening of buff wheels without tearing the buff face, breaking threads or leaving jagged, rough or uneven surfaces.

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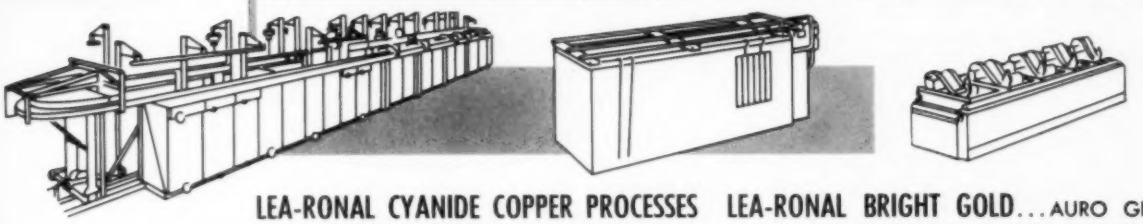

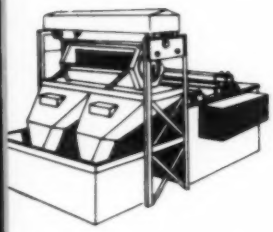

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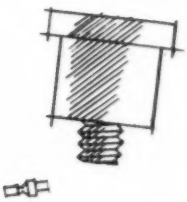
CUPRALL produces high speed buffable copper where brilliance is not required.

Q-STRIKE designed for operation with Q-Level; produces superior foundation; advantageous as an undercoat for all cyanide copper baths and nickel plating; increases lustre and hiding characteristics of subsequent copper or nickel.

Q-LEVEL produces lustrous copper deposits having excellent "hiding" characteristics.



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...COPPER GLEAM bright ductile deposits with exceptional leveling characteristics.

CUPROTYPE smooth, ductile, tree-free, heavy deposits at high speed. Adaptable for electroforming, electrotyping, printed circuitry, etc.

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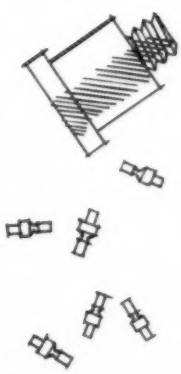
uniform lustrous deposits over a wide current density range. High speed deposition with ease of color control.



LEA-RONAL BRIGHT NICKEL... NICKEL GLEAM N-222

ductile deposits, with exceptional leveling characteristics, high throwing and covering power.

NICKEL GLEAM N-1 a bright all-purpose type bath with exceptional tolerance to impurities. A true "work horse" nickel bath.

NICKEL-GLO a "no sludge" addition agent for barrel nickel, producing bright deposits with simplicity of operation.

MIRRO-GLO similar to Nickel-Glo in effect but for still tank nickel plating.

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bright low pH gold processes for producing brilliant deposits. Can produce 24K or Hamilton shades. Exceptionally stable solution, simple to operate, excellent metal distribution and solderability. Hardness can range from 200-400 Knoop.

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produces bright, hard tarnish-resistant deposits at high rates of speed from crystal clear solution. For industrial or decorative uses.

LEA-RONAL BRIGHT ZINC...

a bright zinc for barrel and still operation. Stable brighteners have long staying power.

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a bright protective cadmium electrodeposit for use on both ferrous and non-ferrous metals.

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exceptionally effective addition agent for cyanide copper baths; aids anode corrosion, reduces cyanide breakdown.

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liquid rinse aid which promotes free rinsing and fast drying, hence reduces staining and spotting of plated pieces.

WETTING AGENT CW-7...

addition agent for all cyanide copper plating baths, particularly Lea-Ronal. Benefits anode corrosion; increases tolerance to organic contamination.

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Co-Chairmen Jay Kuhn, Wolverine Plastics, and John Donalds, Dow Chemical, have announced the following subjects to be presented: "Cost Advantages of Plastics in Replacement of Die Castings," "Linear Polyethylene Molding of the Seat Side Shield for The 1960 Ford," "The Dynamic Growth of Plastics in European Cars," and a panel discussion on "The Difference in the Domestic and Foreign Outlook On the Use of Plastics in Automobiles."

FISHER TO GIVE GILLETT LECTURE AT ASTM ANNUAL

John C. Fisher will present the 7th Gillett Memorial Lecture at the 62nd Annual Meeting of the American Society for Testing Materials at Chalfonte-Haddon Hall, Atlantic City, N. J., on Wednesday, June 24, at 5 p.m.

This lecture, jointly sponsored by ASTM and Battelle Memorial Institute, commemorates Horace W. Gillett, first director of Battelle and one of this country's leading metallurgists.

It is now known that metals and other crystalline materials deform plastically through the motion of dislocations. These imperfections, which are wrinkles in the atomic layers of a crystal, have been observed by a number of experimental techniques, and their motion has been followed during the course of plastic deformation. High strengths can be achieved by eliminating dislocations entirely, or by the more common method of blocking their motion. At present the dislocation concept makes it possible to account semi-quantitatively for the strength of alloys.

Dr. Fisher is physicist, metallurgy and ceramics, Research Department, General Electric Co., Schenectady. He is an authority in the fields of metal physics and research analysis. Dr. Fisher received his Bachelor's degree in mathematics from Ohio State University in 1941 and his Doctor of Science in mechanical engineering from Massachusetts Institute of Technology in 1947. After graduation from Ohio State, Dr. Fisher joined Battelle Memorial Institute as a research engineer. In 1942 he became a member of the staff of Massachusetts Institute of Technology, and in 1947 he became associated with the General Electric research laboratory, first as research associate, then in 1950 as manager, Physical Metallurgy Section; and in 1957 he achieved his present position as physicist.

PLASTICS CONFERENCE DATES ANNOUNCED

The Society of Plastics Engineers, Inc. report their 16th Annual Technical Conference will be held January 12 through 15, 1960, at the Conrad Hilton Hotel in Chicago, Illinois. Plans for the meeting are already well underway under the General Chairmanship of Franklin L. Fine of Rohm & Haas Co.

Mr. Fine reports every major aspect of plastics engineering will be covered in the Conference. Included for the first time in this meeting will be several symposia based on the interests of the professional activ-

ZINC INSTITUTE UNVEILS DETAILS OF RESEARCH PROGRAM

Leading North American zinc producers from all over the nation gathered in Chicago on April 23 for the opening session of American Zinc Institute's 41st Annual Meeting at the Drake Hotel. Important visitors from Canada, Australia, England, Wales, Germany, Mexico and Japan were also in attendance.

The program, conducted jointly with The Galvanizers Committee and Lead Industries Association included a talk by O. W. Bilharz, coordinator for base metals, U. S. Department of the Interior, on the "Executive Reserve Program of the Office of Minerals Mobilization;" Dr. Schrade F. Radtke, research director of the recently initiated joint AZI-LIA expanded research program delivered a progress report; John Veckly, director of advertising for U. S. Steel Corp. spoke on "Advertising and Promotion in the General Sales Campaigns of the Steel Industry;" K. S. Fitzsimmons, chairman of The Galvanizers Committee and superintendent of Republic Steel Corp.'s Stark Works introduced N. E. Cook, general superintendent of galvanizing, Wheeling Steel Corp., who presented the committee's annual award for 1959. H. I. Young, chairman of AZI's nominating committee for directors and president of American Zinc, Lead & Smelting Co., read his committee report. Simon D. Strauss, president of American Zinc Institute and vice president of American Smelting & Refining Co., presided.

He was followed by C. R. Ince, vice

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president of St. Joseph Lead Co. who spoke on "Production and Consumption of Zinc in the United States;" and R. Lewis Stubbs, director of England's Zinc Development Association who discussed "Zinc Outside the USA with Emphasis on Russia." Jean Vuillequez, vice president of American Metal Climax, Inc. served as chairman.

Dr. Schrade F. Radtke, director of the recently initiated joint AZI-LIA Expanded Research Program reported that the internationally backed program has now reached operative proportions, with an open-end budget. Finances for additional projects in the future will be contributed by backer companies to carry on all necessary work, he declared.

Created to promote the growth and expansion of markets for zinc and lead, the Expanded Research Program was launched in September of 1958 under the direction of the Industry Development Committees of American Zinc Institute and Lead Industries Association, and is sponsored by zinc and lead producing companies in the U.S., Canada, Mexico, Great Britain, Peru and Australia.

Research is currently underway or programmed in the United States, Canada, Great Britain, Holland and Australia, Dr. Radtke reported. For optimum efficiency as well as organizational expediency, research is being assigned to existing independent laboratories, laboratories of member companies, government laboratories here and abroad in the free world, and universities, he said.

Dr. Radtke listed a number of research projects currently underway, including investigations at Battelle Memorial Institute, Columbus, Ohio, into improved electroplated coatings for zinc die castings employed widely by the automotive and appliances industries. According to Dr. Radtke, the Battelle research shows that two newly improved plating approaches already in commercial use provide dramatically increased corrosion resistance.

Other research is being performed on the cathodic protection of maritime tankers with zinc anodes, development of coatings to minimize "wet storage strain," zinc battery cans with extended service life, and comparative corrosion-evaluation tests of various forms of zinc-protected steel sheet, rolled zinc, and aluminized steel in a cross-section of representative atmospheres.

Part of the research program is devoted to product improvement, seeking to minimize limitations as well as enhance inherent advantages, said Dr. Radtke. A second and important objective is the development of new products, new applications, and new markets, he said.

In his talk, "The Executive Reserve Program of the Office of Minerals Mobilization," O. W. Bilharz, Coordinator for Base Metals, U. S. Department of the Interior, discussed the urgency of U. S. preparedness for war, with special emphasis on emergency leadership. A critical requirement in this preparation is the advance enlistment and training of outstanding executives and administrators from industry, labor, agriculture and the professions to be at wartime business at a moment's notice, declared Mr. Bilharz.

The recently created National Defense Executive Reserve—a government-wide program with units in at least 15 departments and agencies of the Federal Government—will include about 40 positions of top caliber in metals and minerals in its central office plus an additional 10 to 20 in eight regional offices of the Office of Civil and Defense Mobilization, he said.

Mr. Bilharz reported that zinc and lead officials selected for the Executive Reserve had already participated in orientation and training conferences in Washington, and quoted a recent statement by President Eisenhower praising the patriotism of these individuals. Bilharz cited the selfless participation of the zinc and lead industries in past national emergencies, and urged continued response to meet the new demands imposed by an atomic age.

ATLANTIC CITY SCENE OF ASTM ANNUAL MEETING

The education of the engineer in the materials sciences, the use of isotopes in metals analysis and testing, basic research, and an open forum on standardization of materials for nuclear reactors will be features of the 62nd Annual Meeting of the American Society for Testing Materials at Chalfonte-Haddon Hall, Atlantic City, N. J., June 21–26, 1959.

Sessions on fatigue, effect of tempera-

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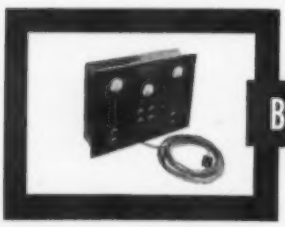

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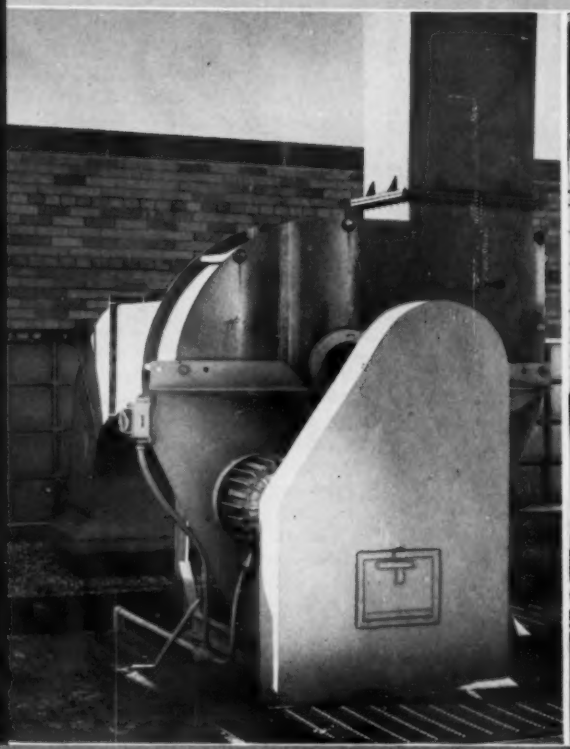
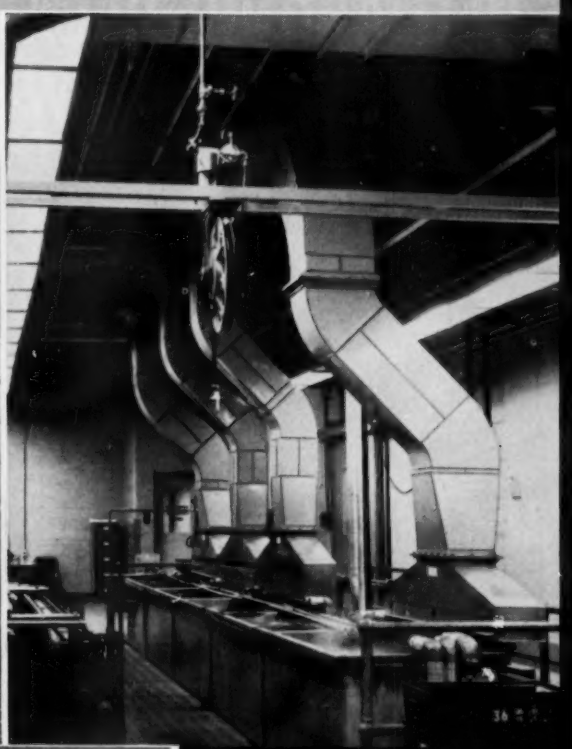


Complete Boltaron 6200 installation... ducts, tanks, hoods, blowers.



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- Protects against most corrosive fumes and liquids in any combination.
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- Non-sparking—will not support combustion —handles fumes and liquids.
- High dielectric strength.
- Extremely lightweight—non-porous—and smooth surface.
- Tensile strength is 8000 psi.
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IPF systems fabricated from Boltaron 6200 are being used across the country by many progressive manufacturers to solve a wide variety of industrial problems, especially where corrosive fumes and liquids have been extremely costly to handle. Performance proves Boltaron 6200 systems help decrease operating costs—increased operating efficiency.

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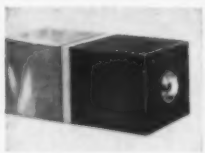

In determining which ultrasonic cleaner to buy, remember that all ultrasonic cleaners are not alike. There is variation in uniformity of cavitation. There is variation in the transducer — and the transducer is the heart of an ultrasonic cleaner. The Multipower transducer developed by Acoustica research, multiplies the power and efficiency of ultrasonic action. Cleaning is faster, labor costs are lower.

Acoustica ultrasonic cleaners are engineered and produced to the finest standards, unequaled in quality and value. Off-the-shelf in capacities from 1 to 75 gal. or custom built to 5000 gal. Expert Acoustica engineers can help you with your cleaning problems. Send for further information.

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ture, steel, spectroscopic excitation sources, microscopy, identification of water-formed deposits, and visual aids for standardizing and communicating product appearance will round out the program of 36 technical and report sessions.

The Symposium on Education in Materials scheduled for the morning and afternoon of June 22 will provide frank and friendly discussion of the viewpoints of responsible men in the fields of engineering education and representatives of industry. It is being sponsored jointly with the American Society for Engineering Education. At noon, the symposium will be supplemented by a special luncheon at which Dr. Eric A. Walker, president of The Pennsylvania State University, will be the speaker.

An informal symposium on the use of isotopes in metals analysis and testing sponsored by ASTM Committee E-3 on Chemical Analysis of Metals will present late information on that subject, Monday afternoon and evening, June 22.

The annual president's luncheon will be held on Tuesday noon, June 23, at which Kenneth B. Woods will present the annual president's address. Awards, presentation of highlights from the board of directors' report, and recognition of 50- and 40-year members will be made at the luncheon.

The annual Edgar Marburg Lecture, established by the Society to honor its first secretary, will be presented Tuesday, June 23, at 5 p.m. Dr. Herman F. Mark, director, Polymer Research Institute of the Polytechnic Institute of Brooklyn, will speak on "New Polymers—New Problems."

The Gillett Memorial Lecture, sponsored jointly by ASTM and Battelle Memorial Institute to honor Horace W. Gillett, first director of Battelle, will be presented by Dr. John C. Fisher, physicist, metallurgy & ceramics, research department, General Electric Co. His subject will be "The Role of Dislocations in Plastic Deformation" (of metals).

On Wednesday evening, the banquet and entertainment sponsored by the Philadelphia District Council will provide relaxation for a week otherwise filled with intensive technical activity.

NAMF CHARTERS CONNECTICUT CHAPTER

The fourteenth affiliated chapter of the National Association of Metal Finishers received its charter on April 18.

The presentation of the charter to the newly formed Connecticut Valley Association of Metal Finishers was made by Frank Kaiser, NAMF secretary-treasurer, at a luncheon at the Hotel Statler-Hilton in Hartford, Connecticut. Arrangements for the luncheon meeting were handled by a local committee headed by Charles T. Smith, plating division manager of Danbury Metal Finishing, Danbury, Conn.

Your finest work starts with Federated Plating Materials: No Federated plating material is approved for marketing before it has proven its quality through continuing Asarco research. Thus top performance is assured.

This policy of research and testing has rewarded the plating industry with Conducta-Core lead anodes which have greater throwing power, yet last three or four times longer than other lead anodes. Cadmax, addition agent for cadmium plating, is another example of superior materials. So too is Zimax for zinc plating, Nimax, a nickel plating brightener, and new Conmax, a conversion coating for cadmium and zinc plated parts. All do a better job at lower cost.

Your Federated representative or distributor will be glad to document this superiority. And you'll prove it for yourself when you standardize on Federated materials. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

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Federated products for the Plating shop include ANODES: Copper; lead, including the famous Conducta-Core; zinc, tin, tin-lead, cadmium, brass, silver. NICKEL SALTS: Constant quality control assures full nickel content and identical plating characteristics from every lot. PLATING ADDITION AGENTS: Cadmax for still or barrel cyanide cadmium plating; Zimax liquid or powder; Nimax for low cost bright nickel plating; Conmax, a conversion coating, for cadmium and zinc plated parts.

Remittance must accompany all book orders placed with AES Headquarters.

1958 Book of ASTM Standards—Complete set of 10 volumes. Nonmembers $116.00, members $105.00.

The entire 10 parts of the 1958 Book of ASTM Standards have been published by the American Society for Testing Materials. The contents of Part 2 were published in May PLATING, page 456. The contents of Parts 1, 3, 8 and 9 are included here. The first part off the presses was Part 2 on Non-Ferrous Metals. This was followed by Part 9 on Plastics, Electrical Insulation, Rubber, and Carbon Black; and Part 4 on Cement, Concrete, Mortars, Road Materials, Waterproofing, and Soils.

The Book of ASTM Standards is the American Society for Testing Materials' largest publication venture. It represents one of the main reasons for the society's existence. Distributed throughout the world, ASTM standards are used to cover the production, purchase, and evaluation of millions of dollars worth of materials annually. The size of the book has increased steadily and rapidly and will continue to grow because as the society's technical committees' work increases many more specifications and tests will be issued.

The increase from 7 to 10 parts in 1958 was necessitated by a growth in size of individual parts to the point where they could no longer be bound economically and were becoming unwieldy in size.

The statistics alone on this monumental reference work upon which American industry is so dependent for its materials requirements are impressive. Within the 10 parts are contained 2450 standard specifications, methods of test, definitions of terms, and recommended practices. These occupy 13,600 pages.

The Book of ASTM Standards is published on bible paper to conserve shelf space and weight and is bound with blue cloth covers and red backstrap.

Each part is complete with a detailed subject index and a list of standards in numeric sequence.

To keep this book up to date, supplements will be issued to each part late in 1959 and 1960. As a service, a complete index is furnished without charge with each set of the Book of ASTM Standards.

Part 1. Ferrous Metals Specifications (Except Test Methods), 1560 pp, 290 standards (January 1959). Nonmembers $12.00, members $10.80.

Steel (both carbon and alloy); structural and rivet; boiler and pressure vessel steel plates; concrete reinforcement; commercial bar; hot and cold finished bars; welding electrodes, rods; bearing steel; sheet and strip; rails and track accessories; springs and spring wire; billets, forgings, blooms, axles; wheels and tires; castings; chain; bearings; bolting, pipe fittings; pipe and tubing; zinc- and lead-coated steel articles; wrought iron; cast iron; malleable iron; ferro-alloys; and metal powder products.

Part 3. Methods of Test for Metals (Excluding Chemical Analysis), 980 pp, 119 standards (December 1958). Nonmembers $10.00, members $9.00.

Metallography; tension; compression; bending; hardness; impact; magnetic particle testing; hardenability; grain size; creep; radiographic standards; linear expansion; inclusion content; heat treatment; thermal analysis; corrosion; weight thickness and uniformity of coatings; verification of testing machines; electrical and magnetic properties of metals; density; particle size; sampling; ultrasonic testing.

Part 8. Paint, Naval Stores, Aromatic Hydrocarbons, Coal, Coke, Gaseous Fuels, Engine Antifreeze, 1424 pp, 353 standards (February-March 1959). Nonmembers $12.00, members $10.80.

Pigments, oils, and thinners; drying oils and driers; shellac, varnish and varnish materials; resins and resin solutions; lacquer and lacquer materials; paint tests; traffic paints; paint weathering tests; putty; printing ink; bituminous emulsions; naval stores; coal; coke; aromatic hydrocarbons; antifreezes; and gaseous fuels.

Part 9. Plastics, Electrical Insulation, Rubber, Carbon Black, 1680 pp, 290 standards (December 1958). Nonmembers $14.00, members $12.60.

Electrical insulating materials, varnishes, tubing, tapes, sheet, rods, oils, askarels, porcelain, paper, mica, matting, asbestos yarns and roving; molded materials; laminated thermosetting materi-

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NEW HORIZONTAL "FINISHMASTER"

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- **VARIABLE SPEED** motor drive . . . any barrel speed to finish *any* material.
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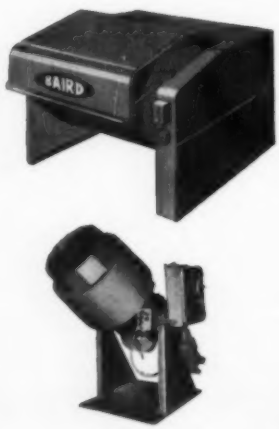

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Narda SonBlasters offer the most complete line of lowest-cost mass-produced ultrasonic cleaners!

Narda's mass-production techniques assure you the most complete line of ultrasonic cleaners at the lowest prices in the industry! From the smallest 35-watt to the amazing 2500-watt unit with a tank capacity of 75 gallons, Narda's SonBlasters are available **now**—off-the-shelf—for immediate delivery. And with a full 2-year warranty besides!

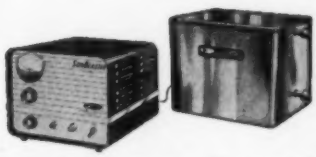
Proper cleaning is essential to perfect plating. Tarnish, corrosion, oxidation, grease and oil deposits, and other foreign matter are removed quickly and thoroughly with a Narda SonBlaster. Regardless of the configuration, intricacy or presence of minute crevices, the power of Narda ultrasonic cleaning will help you prepare for plating, faster, better and cheaper!

No matter what you need in ultrasonic cleaning equipment, you'll find Narda's complete line of production-size units have the quality, power, performance, capacity and appearance of cleaners selling up to three times their price! Write for more details **now** and we'll include a free questionnaire to help determine the precise model you need. Address: Dept. PL-35.

Generator G-202 **Transducerized Tank NT-202**
35 watts **Capacity: ⅜ gallon**

An amazingly efficient, yet inexpensive, ultrasonic cleaner. Duty cycle timer permits operator to turn the unit on, set it, and leave; the SonBlaster will turn off automatically at the end of the cycle. Four choices of timers—from 0-15 min. to 0-120 min. Also available without timer at slightly lower cost (G-201).

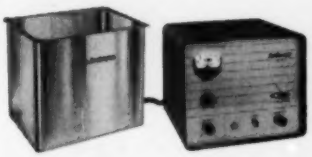
$220



Generator G-601 **Transducerized Tank NT-602**
60 watts **Capacity: 1 gallon**

A more powerful production-type unit, with a special circuit and selector switch permitting operator to alternate between two tanks, when items being cleaned require different solutions or a two-step process.

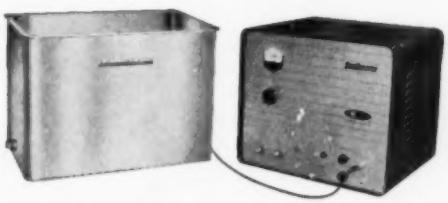
$350



Transducerized Tank NT-1505 **Generator G-1501**
Capacity: 5 gallons **200 watts**

The lowest price in the industry for a tank of this capacity and activity. Generator also will operate 2, 3 or 4 submersible transducers at one time, with just a turn of the load selector switch on the front panel.

$695



Transducerized Tank NT-5001 **Generator G-5001**
Capacity: 10 gallons **500 watts**

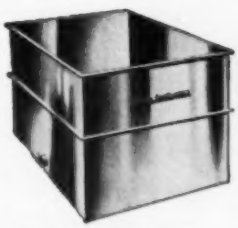
Generator features standby switch for longer life and load selector switch on the front panel to operate up to 8 submersible transducers or 8 NT-602 or 2 NT-1505 transducerized tanks at one time. Larger tanks available on special order.

$1325

Submersible Transducer NT-605

Heli arc welded stainless case, hermetically sealed for safe, leak-proof immersion. Radiating face: 27 sq. in. Effective plane of radiation: 40-50 sq. in. (approximately 10" x 5"). Effective cavitation of volumes up to 1200 cu. in. at 24 in. tank height (5 gal.) and 2400 cu. in. at 48 in. tank height (10 gal.). Bulkhead electrical fitting on back allows all wiring connections to be made on outside of tank. For use in any arrangement or location in any shape tank you desire to use. Also available—model NT-604, identical with NT-605, except for pipe thread instead of bulkhead fitting, permitting electrical connections inside of tank.

$130

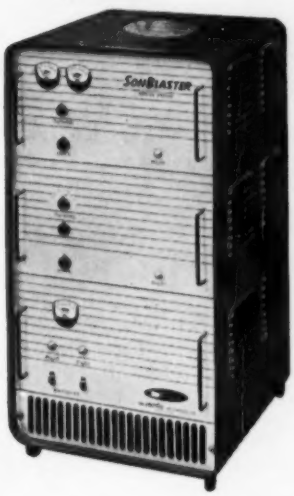


Transducerized Tank
NT-25001
Capacity: 75 gallons

Powerful unit drives the largest mass-produced industrial-size transducerized ultrasonic cleaning tank made! Also energizes up to 40 Narda 60-watt submersible transducers (NT-604 or -605). Capable of energizing tanks measuring up to 150 square feet of area by 2' or 3' high.

$4360

Generator G-25001
2500 watts



Consult with Narda for all your ultrasonic requirements. The SonBlaster catalog line of ultrasonic cleaning equipment ranges from 35 watts to 2.5 KW, and includes transducerized tanks as well as immersible transducers which can be adapted to any size or shape tank you may now be using. If ultrasonics can be applied to help improve your process, Narda will recommend the finest, most dependable equipment available—and at the lowest price in the industry!

For custom-designed cleaning systems, write to our Industrial Process Division; for information on Chemical processing applications, write to our Chemical and Physical Process Division; both at the address below.

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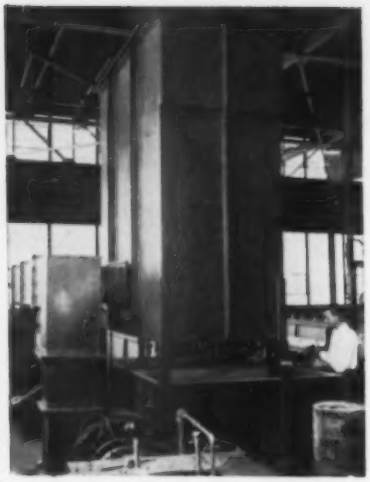

Steel Pickling Installation

KNIGHT Fume Washers

Knight Fume Washers are wet contact scrubbers. The working surface is BERL Saddle packing. This inert material provides maximum surface area with minimum pressure drop for efficient scrubbing.

Each unit is designed to provide low-cost operation, minimum fan power and water consumption. Each has a mist eliminator section through which the washed gas is discharged.

Knight Fume Washers are fully protected against corrosion by application of Pyroflex, Sealon or Neoprene lining to the full-welded steel shell. For hot gases an acid-proof brick lining is installed over the membrane. All internal parts such as the grillage, BERL Saddle packing and distributor are made of acid-proof material. Thus, the entire unit is inert to chemicals being handled. Typical fume removal installations:

HCl and organic vapors
H_2SO_4 pickling fumes
SO_2 and SO_3 gases
Chlorine gas
Smelter dust, fly ash
Plating tank exhaust
Nitric Oxides and HF

Write for Bulletin No. 90

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als; vulcanized fiber sheets; enclosures and servicing units; plastics; allyls, phenolics, ureas, vinyls, cellulose, melamines, foams; rubber products, carbon black, fire hose, belting, gloves, matting, tape, wire and cable, rubber-coated fabrics, cements, sponge rubber, hard rubber, brake hose, blankets, foam, automotive, synthetic elastomers.

Effect of Halide Addition to the Sulfuric Acid Pickling Bath by M. Haftel and W. L. Reichel, Industrial Test Laboratory, Philadelphia Naval Shipyard, U. S. Navy. Feb. 1957. 27 pages. 75 cents. Order PB 131794 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Sodium halide additions to the standard sulfuric acid pickling bath reduces acid attack on base metal, especially for special treatment steel, according to this report. The effect is described as more pronounced with increases in pickling time. The additions, however, had no apparent effects on scale removal rate, surface appearance, or surface passivation and paint adhesion. Halide concentrations of 0.1 per cent are recommended. Because there is little difference in inhibiting properties of halides, the low-cost sodium chloride is considered most suitable.

Cleaning and Passivation of Corrosion-Resisting Steels by L. Lowry and J. Thompson, Naval Gun Factory, U. S. Navy. 28 pages. 75 cents. Order PB 131964 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

This report contains a survey of typical cleaning methods for removing surface contaminants such as scale, flux, slag, metallic lubricant and iron from the surface of corrosion-resisting steels and discusses the function of passivating treatments in nitric acid solutions as a final cleaning operation. The rate of attack of nitric-hydrofluoric acid pickling solutions employed to remove scale or as a "whitening" solution following other methods of scale removal was evaluated with typical steels of the AISI type 200, 300 and 400 series. The rate of attack of nitric acid passivating solutions was determined with the same materials. Also evaluated was the effect of chloride contamination of nitric acid passivating solutions on the rate of attack. Suggested methods for detecting iron contamination on surfaces of finished corrosion resisting steel articles were studied, and a method of producing artificial iron contamination for test purposes was developed. Among a number of conclusions, it was found that generally the rate of attack by nitric acid passivating solutions on the AISI type steels in the absence of damaging heat treatments was low, while the rate by nitric-hydrofluoric acid pickling solutions was appreciably greater.

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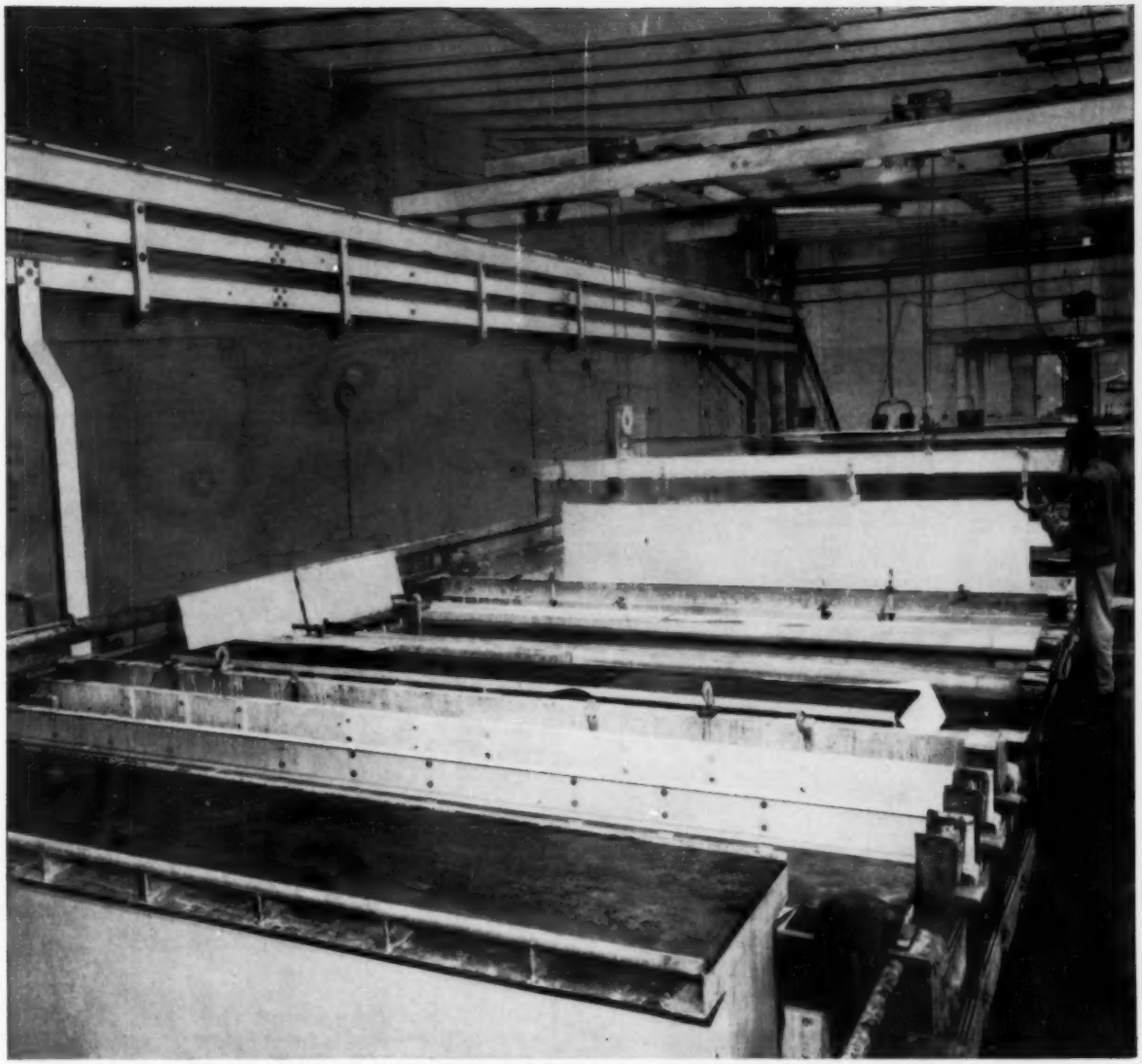

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For Exciting Drama Watch **"Alcoa Theatre,"** Alternate Mondays, **NBC-TV,** and **"Alcoa Presents,"** Every Tuesday, **ABC-TV**

INDUSTRY NEWS

Allied Research Products', Inc. recent annual sales meeting held at the company's headquarters in Baltimore, Maryland. Here is the entire sales, service, promotion and development group together for the first time since the acquistion of the Wagner facilities and products last June.

WYANDOTTE EXPANDS IN MEXICO

Wyandotte Chemicals Corp. has announced the formation of Productos y Especialidades Quimicas, SA de CV, a new Mexican subsidiary company. It is jointly owned by Wyandotte and Mexican businessmen for the manufacture and sale of cleaning products for business and industry.

The new company will have plant and office headquarters at Puebla where the general line of Wyandotte's J. B. Ford Division products will be manufactured.

The establishment of Productos y Especialidades Quimicas, will permit the expansion of J. B. Ford Division product sales in the rapidly growing Mexican market.

ESBEC BARREL FINISHING MOVES TO NEW PLANT

Esbec Barrel Finishing Corp. moved

Better Buffing and Polishing?
ANSWER: ALWAYS USE
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Formax manufactures a complete line of Buffing and Polishing Compounds in bar, tube and liquid form suitable for all classes of metal, plastic and lacquer finishes. Formax compounds used together with the famous Formax ZIPPO long wearing buffing wheels make a combination that's hard to beat. Our extensive manufacturing, laboratory and testing facilities are always at your disposal.

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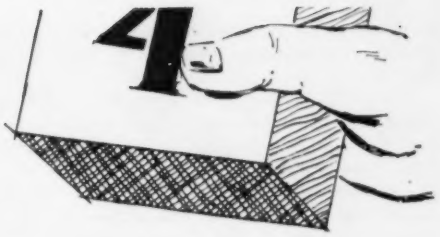

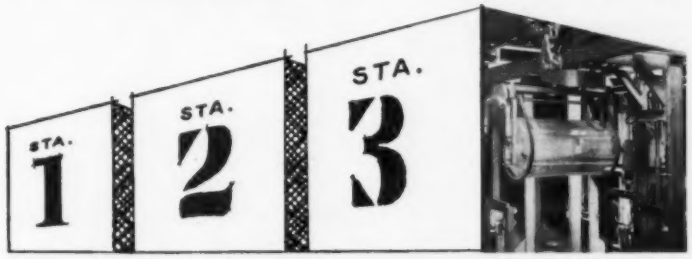

ABBEY-MATIC LETS YOU DECIDE!

Automate all, or any part of your plant — by process, by station; then add or remove at will. Only ABBEY-Matic interchangeable station design permits flexibility to adjust easily with your changing needs.

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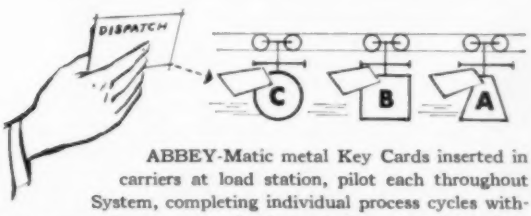
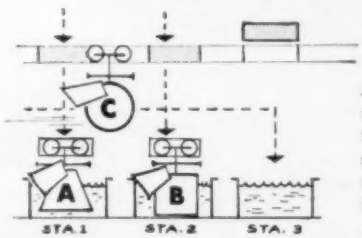
Multi-Cycle Selection, Positive, Fool-Proof



ABBEY-Matic metal Key Cards inserted in carriers at load station, pilot each throughout System, completing individual process cycles without error — human or mechanical. A, B, and C (above) go their separate, precise ways automatically.

LEAP-FROGGING CARRIERS

and Stationary-Cell Processing

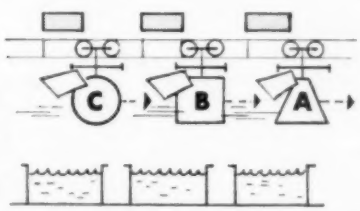


SUBSTITUTE TRACK SEGMENTS CARRY THE TRAFFIC

ABBEY-Matic Carrier lowers into station on main track segment. Substitute segment (shaded) fills gap for other carriers to travel over (leap-frog) occupied station. (Above) B leap-frogged A; C leap-frogs A and B to enter next available scheduled station.

STATION BY-PASSING

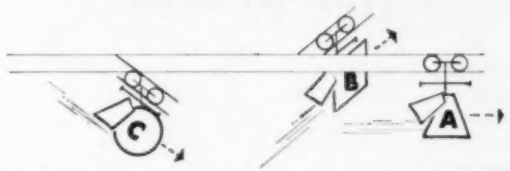
Unimpeded Conveying over Unscheduled Stations



Stations not used in a process cycle and undesignated by Key Card are automatically by-passed by the carriers involved. A, B, and C (above) are by-passing unscheduled processes without delay. Exclusively ABBEY-Matic!

SWITCH LINES (AUTOMATIC)

Accumulation, Storage, Automatic Feed



Carrier-loads completing cycles in one section of ABBEY-Matic System are laterally transferred to short-cut balance of System. Detours from main System into supplementary processing sections are also automatic. A (above) stays in main System; B and C switched off. *AC, DC positive stationary contact; no arcing; live entry. Smoothest* sealed ball and roller bearings. *Hydraulic* action. Big reasons why ABBEY-Matic is *first* in multi-process full-automation.

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R. O. Hull & Co., Inc., 3136 Hilton St., Ferndale, Mich.
Ross Industries, Inc., 5890 Commonwealth Ave., Detroit 8, Mich.
Ardco, Inc., 5000 W. 73 St., Chicago 38, Ill.
Nicromatic, Ltd., 20 Drummond St., Toronto 14, Ont., Can.

to a new plant in Stamford, Conn., on May 1. It is located at 190 Henry Street, Bldg. 16.

Morris S. Shipley, Esbec's president, states that the move was dictated by a need for additional space to accommodate Esbec's continued expansion in all phases of its activities. All administrative, engineering, production and testing operations—previously divided between Meriden and Byram, Conn.—will now be consolidated under one roof. This consolidation is also geared to increase the overall efficiency of services in the barrel finishing field and to provide more complete integration of administration, research and production facilities.

RESEARCH CONFERENCE HELD BY INDUSTRIAL WASTES TASK COMMITTEE

The National Technical Task Committee on Industrial Wastes held a Special Meeting on Research at the Robert A. Taft Sanitary Engineering Center in Cincinnati, April 27 and 28. Some twenty papers, dealing with U. S. Public Health Service studies in the broad field of industrial research, were presented.

Of particular interest to metal finishers was "Studies on the Effect of Toxic Heavy Metals on Biological Treatment Processes." Chromium is presently being investigated and up to 15 mg/l the removal efficiency of BOD has not been effected. At 0.5 and 2 mg/l of hexavalent chromium, no Cr^{3+} was found in the effluent, but at 15 mg/l there was 8–12 mg/l present. The presence of chromium in the secondary settler has resulted in zero nitrification and the settled sludge does not become anaerobic in the 24-hour settling period. Studies will be carried out at a 50 mg/l hexavalent chromium level. A unit has also been set up to determine the effect of "slug" doses of chromium at 10 and 100 mg/l. No effect of a 10 mg/l "slug" on sludge and BOD removal efficiency has been noticed. Another interesting paper had to do with oxygen requirements of and effects of certain constituents on fish carried out at the Corvallis Field Station in Oregon. There is evidence that the concentration of free hydrocyanic acid in a solution largely determines the toxicity of solutions to fish. Analytical studies are under way for the determination of HCN in complex cyanide solutions.

METAL & THERMIT FURTHERS ORGANIC CHEMICALS DEVELOPMENT

Metal & Thermit Corp. has entered into development contracts for the use of its organic chemicals with B. F. Goodrich Chemical Co., Mobay Chemical Co. (jointly owned by Monsanto and the German Bayer interests), Dow Chemical Co. and Permachem Corp., H. E. Martin, president, has announced.

He also revealed that the company's development work with the U. S. Air Force at Wright Field has resulted in the production of one compound now flying experimentally in jet airplanes as an additive to the lubrication. "It acts as a stabilizer for high temperature service, permitting full throttle operations heretofore unattainable because of the inability of other compounds to withstand the high temperatures encountered," he said.

It is expected that these developments will in time materialize into substantially increased business for the company's plant in Carrollton, Ky.

SERVICE-SCREW HAS NEW NAME

Service-Screw Products Co. has announced the addition of electropolishing racks to its line. At the same time it has taken a new name and will be known as Servi-Sure Manufacturing Co. The change was prompted by the firm's increasing concentration on equipment for the metal finishing industry. Ernest Rosner continues as president of the firm with James K. Trinz the vice president in charge of the Service-Rack Division.

GUMM APPOINTS FLORIDA DISTRIBUTOR

Frederick Gumm Chemical Co. has announced the appointment of Allied Plating Supplies as distributor of their CLEPO products in the State of Florida. Allied maintains a complete stock for the metal finishing industry in their warehouse at 5000 E. 10th St., Hialeah, Florida. Sales will be directed by Frank X. Marinello, president of Allied in conjunction with Abe Schorr, distribution manager, and Earl Kennedy, sales manager.

Container pivots 120° to facilitate loading-unloading.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

ALMCO *Vibrasheen* FINISHES FASTER!

Constant vibratory motion . . . that's the secret of faster deburring and finishing you now get by using the new ALMCO *Vibrasheen* Method!

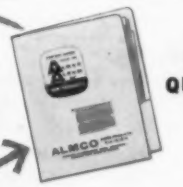
This amazing metal finishing machine vibrates a full 5 cu. ft. load* of parts and media . . . uses scrubbing action to remove burrs and finish parts in a fraction of the time required in ordinary barrel finishing operations.

The new *Vibrasheen* Method is particularly suited for faster burr removal from parts, and finishing hard-to-reach internal crevices. Can be used for deburring, descaling, cleaning, burnishing and surface refinement.

For full story on *Vibrasheen* Method and on processing sample parts, write for the new ALMCO Album of New Products!

** Smaller and larger models also available.*

FREE!
NEW PRODUCT ALBUM
Gives full information on new Almco Supersheen Systems. Describes new and better machines, methods and media. Write today!



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QUEEN PRODUCTS DIVISION
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what's DIVERSEY up to now?

See us at Booth 44-C at the Industrial Finishing Exposition at the Detroit Artillery Armory. Watch our demonstration on the use of Diversey products in preparing aluminum for anodizing.

For instance . . .

New Diversey 17 non-silicated soak cleaner—a new type alkaline cleaner that eliminates film and etching problems. Designed for cleaning buffed work as well as work to be etched, anodized and bright dipped.

For instance . . .

New DS-9 Bright Dip Process—provides a specular finish on stainless steel without buffing or polishing. Removes forging scale and weld scale.

For information on these and several other new Diversey products write: *Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.*

DIVERSEY.

NEW DEERING, MILLIKEN RESEARCH CENTER

The Deering, Milliken Research Corporation was organized to serve a number of different mills, with Milliken as their selling agent. The research corporation recently dedicated a new $2-million research center in Spartanburg, South Carolina. It contains the most modern facilities; it is the world's largest industrial textile research center, and it is here that the research phase of the "buff cloth program" is carried out. Among the facilities of the new research center are nine chemical laboratories, an electrical laboratory, physical laboratory, library, experimental machine shop, and a pilot plant with facilities for duplicating many of the production operations carried out in a mill.

SPEED UP PRODUCTION with DOUBLE-ACTION DRYING

Air-dry as you spin-dry with the new, improved New Holland Model 20 KREIDER CENTRIFUGAL DRYER

• Now you can *spin-dry* small parts in continuous *fresh air* in as little as 15 seconds.

Double-action drying with peak-efficiency evaporation gives smooth moisture-free surfaces . . . reduces your finishing problems by eliminating the scarring frequently responsible for costly "rejects."

Your operators will be able to boost production, cut costs way down when you install New Holland's easy-to-run Model 20 Kreider Centrifugal Dryer.

SAFER because of Mechanical and Electrical Control Features!

To unlock cover and remove basket, operator must depress foot brake, stop spinner.

Machine cannot start with open cover. Ample clearance allowed for quick loading.

To start spinner, operator must first close cover completely.

SPECIFICATIONS:
1 h. p. motor—220, 440, 550 volts—2- or 3-phase—spins 75-lb. loads at 825 r.p.m. . . . Quiet V-belt drive . . . 30-blade suction turbine draws air through spinner . . . . Arc-welded steel-plate construction . . . Heavy-gauge woven steel mesh basket . . . Weight: 490 lbs. . . . Floor space: Just under 5 sq. ft. . . . Meets N.F.C. specs. **Optional:** J.I.C. Control: Mounted on right, left side or wall. 160° supplementary heat: 2350-watt Chromalox, or steam.

Send for illustrated 4-page folder. Address Dept. P-659 New Holland Machine Company, New Holland, Pa.

NEW HOLLAND MACHINE COMPANY
NEW HOLLAND, PA.

DALIC PROCESS ACQUIRED BY SIFCO METACHEMICAL

A newly formed subsidiary of The Steel Improvement & Forge Co., Cleveland, Ohio, called Sifco Metachemical, Inc., has acquired the business and assets of the parent company's electrochemical division and has purchased the licensing rights in Canada and the United States for the Dalic Process, previously owned by Dalic Metachemical Ltd., Toronto, Canada. Steel Improvement has in excess of 80 per cent of the stock of the new subsidiary.

Associated with Steel Improvement in this new venture are Metachemical Processes Ltd., London, England, and Laboratories Dalic, Paris, France. Steel Improvement has purchased a one-third interest in the English company. H. Denis Hughes, managing director of Metachemical Processes Ltd. and Georges Icxi, head of Laboratories Dalic are retained as technical consultants to Sifco Metachemical, Inc.

GIESEL CONTINUES IN U.N. POST

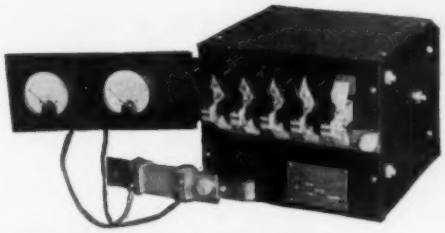
Robert L. Geisel, president of Adolph Plating, Inc., Chicago, has been reappointed finance chairman for the electroplating industry for the United States Committee for the United Nations.

The United States Committee for the United Nations, now in its eleventh year of activity, is a privately supported citizens organization whose chairman is appointed annually by the President of the United States. Working through 120 voluntary national organizations, the purpose of the Committee is to "arouse interest in, disseminate facts about the United Nations and to promote the observance of United Nations Day in the United States."

Mr. Giesel is a member of the Young Presidents' Organization, the Rotary Club of Chicago, second vice president and a director of the National Association of Metal Finishers.

MILTON ROY TO HANDLE ENGLISH LABORATORY EQUIPMENT

Robert T. Sheen, president of Milton Roy Co., Philadelphia, Pa., has announced a 10-year license agreement between his firm and Electronic Instruments Limited, Richmond, Surrey, England, for the sale and manufacture of industrial and laboratory pH equipment in the United States. The exclusive license agreement with EIL also includes EIL's laboratory titrating equipment, portable pH meters, glass electrodes, titromatic analyzers, direct reading fluorimeters, sulfur dioxide gas analyzers, and Vibron electrometers.



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withstand toughest service

Durable *Cast-Grid Resistors* and rugged cam type *Toggle Switches* assure long and effective life of Columbia Plating Tank Rheostats.

Cast-Grid Resistors are designed with liberal capacity to withstand intermittent and momentary overloads. Switches are self cleaning and give positive contact, conveniently located for ease in adjusting tank voltage to the load.

Specify "Columbia" when ordering plating tank rheostats. Standard sizes from 15 to 5000 amperes, 1 to 6 volt drop. Other voltage drops on special order. Furnished complete with voltmeter, ammeter and shunt; also with short circuiting switch and vernier control when specified.

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Special Compounds for Blackening, Stripping and Processing Metal

INCLUDING

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SALES OFFICES: GRAND RAPIDS • INDIANAPOLIS
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New Economy in Filtering Plating Solutions

with

SPARKLER
Wash-off Cartridge Filter

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Booth 286-A 287-A

Fifth Industrial Finishing Exposition, Detroit

Conceived and Engineered for Platers, this horizontal plate filter combines absolute cake stability and ease of cleaning.

The wash-off cartridge is the heart of this filter.

SPARKLER FILTERS

SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS, U.S.A.
Sparkler International Ltd., Manufacturing Plants at Leliegracht 9, Amsterdam, Holland; Toronto, Ontario, Canada; Italy and Australia.

Filtration Engineering & Manufacturing Exclusively for Over 30 Years

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USE READER SERVICE CARD; INDICATE A 660.

Barrel Nickel Plating

●

Costs are always a recurrent problem. Eternal vigilance is still the price of safety or freedom. It is usually simple to add up obvious costs such as labor, materials and equipment. The hidden costs are too often not under control. Rejects may be reprocessed without control adding to costs beyond determined values. Another more insidious cost is the transfer of production costs to overhead. If solutions require considerable maintenance much time is consumed which often is not accounted for.

●

Proper records can do much to find such costs. Records of analysis and additions can show what was added and when and a rough estimate of time made. This can often point the way to less frequent analysis and additions. Anode additions and changes can be forecast by using the figure of 400 ampere hours per pound of nickel. So far as anode recommendations, rolled depolarized anodes are preferred for all nickel solutions of *p*H 5 or higher and in barrels it is not necessary to bag them.

●

True Brite Nickel Brightener has been used for over 10 years and we could quote many compliments. We feel our best compliment was from the customer who told us that we were always the second best to every other vendor of similar products. Being the standard is an old story to us. The solution formulations we pioneered are now standard and widely copied. The only thing that can't be copied is the wider experience we have which enables us to give you that extra freedom from trouble and instant service that keeps your plating good. You've got to try it and see.

TRUE BRITE CHEMICAL PRODUCTS CO.
98 FALLS AVENUE OAKVILLE, CONN.

INDUSTRY NEWS BRIEFS

NORTHWEST CHEMICAL CO. APPOINTS CANADIAN FIRM

The Armalite Co., Ltd., Crystal Arts Square, Toronto, Ontario, has been licensed by Northwest Chemical Co. of Detroit to manufacture and sell its products in Canada.

Armalite has organized a new division known as the Alkali Division. This division will be managed by D. E. Wellman who has represented Northwest Chemical Co. for many years. Mr. Wellman has a wide background of experience in the metal finishing industry.

NEW ULTRASONIC QUARTERLY

Ultrasoundings, a new quarterly illustrated review of ultrasonic progress, has been issued by Acoustica Associates, Inc., Mineola, New York and Los Angeles, California.

The first issue includes several articles describing ultrasonic cleaning applications in industry. In addition, the publication includes brief descriptions of a transducer, a new lightweight, low-frequency echo-ranging device, and new types of ultrasonic liquid level switches for cryogenic and corrosive liquids. The publication will be sent without charge.

NICKEL REPORT FOR YEAR 1958

The availability of nickel in 1958 exceeded the demand for the first full year since 1940. The improved supply-demand position resulted mainly from increased production, virtually complete stockpile deferments, and decreased requirements for nickel in the United States. Despite the improved supply, intense activity continued in exploring for new sources, developing new mines, and planning new and expanding present smelting and refining facilities.

Canada produced about 141,000 tons in 1958, a 25 per cent decrease from 1957. Output in Cuba was 11 per cent lower than in 1957. Domestic production (about 11,800 tons) made a new record, increasing about 17 per cent—equal to 15 per cent of consumption in the United States in 1958, compared with 8 per cent in 1957.

EXHIBIT IN INDIA INCLUDES SEL-REX PRODUCTS

One of the displays of the U. S. Small Industries Exhibit currently touring India consists of a selenium rectifier, plating cycle tanks, and a patented bright gold plating process, all products of Sel-Rex Corp., Nutley, New Jersey. Installed and manned by Indian technicians, the equipment has been used to bright gold plate thousands of souvenirs and sample strips, since the exhibit began touring India in December 1958.

Watching gold beautifying trinkets and sample strips of drab base metals, visitors to the Sel-Rex exhibit ask scores of questions regarding industrial applications of gold and other precious metals.

DR. STERN HONORED BY ELECTROCHEMICAL SOCIETY

Dr. Milton Stern, developer of the recently announced titanium-palladium alloy, was honored by the Electrochemical Society at its meeting in Philadelphia on May 5.

Dr. Stern is technical supervisor of the Metals Research Group in Union Carbide's Metals Research Laboratories, Niagara Falls.

His discovery marked a major breakthrough in the battle against corrosion. He learned that a small addition of noble metal such as palladium or platinum to titanium causes the resulting alloy to be resistant to both reducing and oxidizing environments.

Dr. Stern was selected for the special Electrochemical award in recognition of his paper entitled "The Mechanism of Passivating-Type Inhibitors" which was published in the Society's Journal.

INDICATE A 662 ➤

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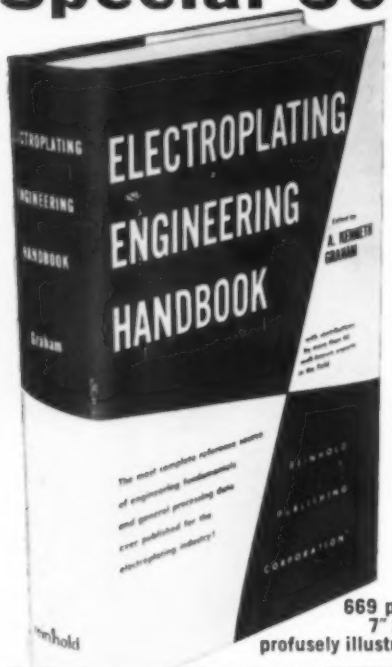

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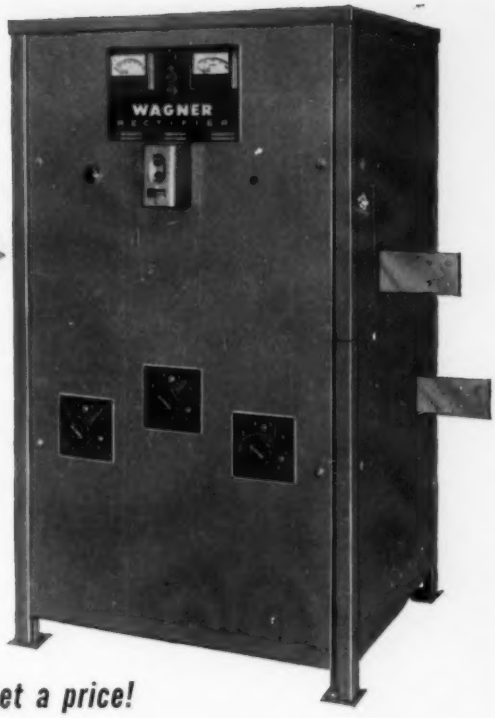

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E—601. Vapor Degreaser—Phillips Manufacturing Co. announces that a new model has been added to their line of vapor degreasers. The "Scotsman" has a low initial cost and is economical to operate, according to the company.

Light-weight and portable, the degreaser will clean up to 300 lb of steel per hour, it is claimed. All electric, it may be connected to any 220 v outlet. Incorporated in the design is a heavy duty vapor control and high temperature shut-off to eliminate fire hazard. The immersion type heater is removable for easy clean-out. The zinc coated steel tank has a solvent capacity of six gal.

E—602. Primer—Allprime, manufactured by Cosden Paint Co., is a low gloss, universal primer for use on aluminum, brass, copper, cadmium, monel, nickel, stainless steel, terneplate, tin, zinc, steel, black iron, gold, silver and platinum. This primer is not intended for outdoor use alone; however, it may be recoated with any type of finishing system. It may be applied by spraying or by dipping, and air dries in 15 min at room temperature to a satin finish, or baked for 10 min at 300F. One gallon will cover approximately 300 square feet at 0.3 of a mil thickness. It is available in clear, black, gray.

E—603. Ultrasonic Cleaning Tank—A new line of Sonogen ultrasonic cleaning tank/transducers is now available from Branson Ultrasonic Corp. Integral heater, dual thermostatic control and twin-wall construction are featured improvements.

The TH series comes in eight standard sizes, ranging from one gallon to thirty-two gallons tank capacity, and a transducer input from 65 r-f watt to 1000 r-f watt. Special sizes and combinations can be made to order.

Heating elements are directly attached to the walls of the tank. The ceramic transducers, which convert electrical impulses from the ultrasonic generator into mechanical vibrations, are mounted against the bottom to provide a uniform cleaning field throughout the tank.

E—604. Buffing Compound Remover—Enthol 230, a new liquid detergent which is said to remove buffing compounds rapidly and economically, has been announced by Enthone, Inc. The new product penetrates and dissolves hardened buffing compounds by forming soluble soaps with them. Solid abrasive particles are detached and settle to the bottom of the tank.

Two to four gallons dissolved in water will make up 100 gallons of cleaning solution. The solution, when operated at 150 to 200F, will remove buffing and polishing compounds from steel, nickel plate, copper, brass, zinc base die castings, gold, silver, aluminum and most other basis metals, according to the manufacturer.

E—605. Anhydrous Chromic Chloride—Diamond Alkali Company announced the availability of anhydrous chromic chloride. The anhydrous chromic chloride produced is said to be of high purity. It is a light, fluffy, purple powder which is insoluble in water but readily water soluble

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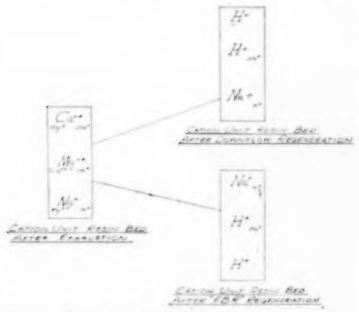
in the presence of trace amounts of chromous chloride or other reducing agents.

Suggested uses are as an intermediate in the manufacture of organic chromium compounds and as a catalyst in the polymerization of olefins. In addition, it is suggested by the company as useful in vapor plating, flame metallizing and in the preparation of high purity chromium metal and mordants.

E—606. Regeneration Method—A cation regeneration method that reportedly results in lower electrolyte leakage, greater uniformity of effluent quality and reduced operating cost has been developed by Graver Water Conditioning Co.

The method, known as FBR Regeneration (for fixed-bed reverse flow), consists basically of a means of flowing regenerant up instead of down while maintaining a fixed, rigid resin bed. A fixed bed prevents channeling or short-circuiting of the regenerant solution.



Conventional and FBR Regeneration contrast

By pumping acid up through the bed, the band of resin richest in hydrogen is at the bottom which is the point the water being treated touches last before leaving the unit. This band becomes a scrubber zone and reduces "leakage" so that a purer effluent is produced.

E—607. Silicon Rectifier—A new water-cooled silicon rectifier designed to provide either regulated or unregulated d-c power for steel, electrochemical, plating, and other continuous processing lines has been developed by General Electric's low voltage switchgear department.

The rectifier employs saturable reactor-amplistat control to maintain the desired current level within plus or minus one per cent with unit efficiencies ranging from 90 to 95 per cent depending upon voltage rating of the equipment.

Available in ratings of 1,000 to 10,000 at voltages up to 300 V, the rectifier may be either manually or automatically controlled by means of the saturable reactor which provides smooth, stepless control from 10 to 125 per cent current output.

One feature of the new rectifier is the short circuit limiting capabilities of the saturable reactor which successfully restricts short circuit current to a value about 20 per cent greater than the current prior to the short circuit. The rectifier is designed to withstand such an output without damage to components.

A completely sealed cell-cooling system greatly reduces the possibility of leaks and provides more efficient cooling than that found in similar units, design engineers said. Use of a water-cooled bus bar completely eliminates the need for rings and gaskets and makes it possible to change cells without draining the system.

E—608. Alkyd Resin—Development of a short oil, non-drying alkyd resin so resistant to weathering that automotive finishes made with it are claimed to be able to retain their original color and gloss for years was announced by Archer-Daniels-Midland Co.

In addition to maximum weather durability, color and gloss retention, enamels and lacquers based on the resin, Aroplaz 2580-X-60, are reported to possess high hardness and good flexibility.

Although designed specifically for baking enamels requiring superior weather resistance, the resin also improves the weather durability of nitrocellulose lacquer finishes according to the manufacturer. As a lacquer plasticizer, it may be used in high concentration without reducing hardness below acceptable levels. Improved gloss and color retention and greater resistance to cracking and checking from weather exposure are obtained.

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E—609. Cadmium Coating Process—A low cost new method for vacuum deposition of cadmium reportedly now makes it possible to protect high tensile steels against corrosion without danger of hydrogen embrittlement. The process has been developed jointly by NRC Equipment Corp. and National Research Corp. Samples, some of which had been flexed repeatedly are claimed to have successfully passed 96 hour salt spray and salt bath tests without trace of corrosion.

The cadmium plating process is related in principle to the vacuum metallizing method now used to decorate plastics, die castings and metal stampings.

It differs from this technique in the metal being vaporized and also in the thickness and crystalline structure of the coating.

E—610. Plastisol Drums—Plastic plating room containers and plastisol drums are being distributed by Lakeland Co. These drums are claimed to be immune to corrosive actions of acid and alkaline industrial chemicals. They are available in five sizes ranging from one to thirty-eight gallons.

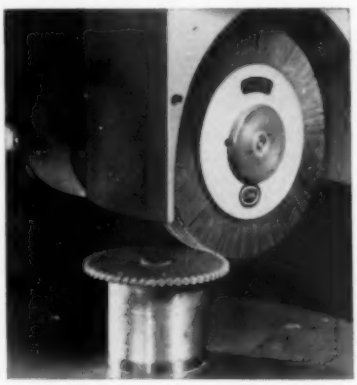
E—611. Spotting-Out Preventive—A tarnish and corrosion inhibitor for copper and brass which minimizes spotting-out of copper and brass plate has been introduced by Enthone, Inc. Called Entek CU-55, the new product reacts with copper and copper alloys to form an invisible coating which is reported to prevent staining, green salt formation, finger marking, pit corrosion and spotting-out under high humidity storage conditions.

A non-toxic liquid which does not contain chromates, it is added to water at a concentration of one per cent by volume and may be used hot or cold. One gallon will treat 500 sq ft of metal surface.

Copper and brass surfaces treated with this corrosion inhibitor will withstand 200 hr exposure to 100 per cent humidity at 100F without loss of luster, according to Enthone.

E—612. Automatic Deburrer—A new concept in the automatic deburring of gears and sprockets which again combines coated abrasives with a machine tool operation has been announced by Minnesota Mining and Manufacturing Co. and Barber-Colman Co.

Two major advantages claimed for the method are consistency in profile from tooth to tooth and from gear to gear, and complete protection for the gear face, which is often subject to impingement using other methods.



The deburring is accomplished as a specially designed, formed PG wheel moves by hydraulic action into working position, automatically feeds into contact with the gear, and retracts to the starting position at the end of a pre-specified contact period—all on a push-button cycle. The wheel and gear spindles operate in a timed relationship so that the work indexes one tooth for each revolution of the wheel.

E—613. Degreasing Machines—A new Baronet standard series of vapor spray degreasers has been announced by Baron Industries.

Said to be efficient and inexpensive, the new standard series consists of five models. Interior lengths range from three to eight ft in length, while the inside depth and width of each is a uniform 24 by 24 in. The degreasers utilize a trichlorethylene vapor solution to dissolve greases, oils and waxes from all ferrous and non ferrous metals. Thorough cleaning and drying of parts by vapor condensation and a hand spray rinse is accomplished in a matter of seconds, it is reported.

(*Continued on page 744*)

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By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

61. ALLOYS

1. *DEPOSITION OF NEW CHROMIUM-IRON ALLOY PLATE OF BANDED STRUCTURE.*
L. D. McGraw, J. A. Gurklis, C. L. Faust and J. E. Bride.
Journal of the Electrochemical Society, *106*, No. 4, April 1959, pp. 302–305.

62. ANALYSIS

a. *THE DETERMINATION OF LEAD IN PLATING ELECTROLYTES USING ETHYLENEDIAMINE TETRA-ACETIC ACID (DI-SODIUM SALT) AND XYLENOL ORANGE INDICATOR.*
K. E. Langford.
Electroplating and Metal Finishing, *12*, No. 3, March 1959, pp. 103, 119.

b. *PLATING TESTS FOR SOLUTION CONTROL.*
J. B. Mohler.
Metal Finishing, *57*, No. 4, April 1959, pp. 55–61.

63. CLEANING

a. *CLEANING PRIOR TO ELECTROPLATING.*
(A Summary of ASTM Tentative Recommended Practice B322–58T, 1958).
Electroplating and Metal Finishing, *12*, No. 3, March 1959, pp. 94, 95, 92.

b. *HOW TO CLEAN ELECTROTYPES BEFORE CHROMIUM PLATING.*
T. E. Wiemeyer.
Products Finishing, April 1959, pp. 52–54.

64. CORROSION

a. *AUTOMOTIVE TRIM: PERFORMANCE AND TESTING.*
Harold A. Kahler.
Products Finishing, April 1959, pp. 22–29.

b. *RESISTANCE OF COBALT TO CERTAIN SOLUTIONS.*
R. S. Young.
Corrosion Technology, *6*, No. 3, March 1959, p. 89.

65. ELECTROPLATING

a. *ELECTROPLATING ON CERTAIN TRANSITION METALS.*
E. B. Saubestre.
Journal of the Electrochemical Society, *106*, No. 4, April 1959, pp. 305–309.

b. *A RADIOISOTOPIC STUDY OF LEVELING IN BRIGHT NICKEL ELECTROPLATING BATHS.*
Seward E. Beacom and Bernard J. Riley.
Journal of the Electrochemical Society, *106*, No. 4, April 1959, pp. 309–314.

c. *DETERMINATION OF CRYSTAL ORIENTATION BY HIGH INTENSITY REFLECTOGRAMS.*
G. H. Schwuttke.
Journal of the Electrochemical Society, *106*, No. 4, April 1959, pp. 315–317.

d. *THE ELECTROCHEMISTRY OF NICKEL. I. CODEPOSITION OF NICKEL AND HYDROGEN FROM SIMPLE AQUEOUS SOLUTIONS.*
John Yeager, J. P. Cels, Ernest Yeager, and Frank Hovorka.
Journal of the Electrochemical Society, *106*, No. 4, April 1959, pp. 328–336.

e. *EFFECT OF BIOLOGICALLY POLLUTED WATERS IN ELECTRODEPOSITION.*
K. Sommer.
Electroplating and Metal Finishing, *12*, No. 3, March 1959, p. 105.

66. FINISHING

a. *ABRASIVE BELTS HELP REDUCE YOUR TUMBLING TIME.*
Charles G. Tuvek.
Products Finishing, April 1959, pp. 30–34.

b. *THE NATURE OF MECHANICALLY POLISHED METAL SURFACES.*
L. E. Samuels.
Electroplating and Metal Finishing, April 1959, Vol. 12, No. 4, 130–133.

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THE REASON for the elimination of sludge formation is that an anode of phosphorized copper develops an adherent dark brown film during electrolysis, which prevents the formation of free copper particles, but which in no way interferes with the plating operation or increases the electrical resistance of the bath. The phosphorized copper anode also corrodes more evenly, depositing more copper per pound on the cathode; gives a smooth, heavy deposit free from roughness due to lodgment of copper sludge particles, and leaves a small, compact "fish." There is no copper sludge or build-up of copper sulfate in the electrolyte.

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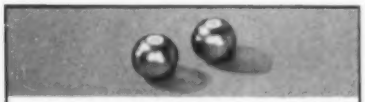

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67. INHIBITION

a. *THE EVALUATION OF CERTAIN ORGANIC NITROGEN COMPOUNDS AS CORROSION INHIBITORS.*
E. J. Schwoegler and L. U. Berman.
Corrosion, *15*, No. 3, March 1959, pp. 44–46.

b. *CORROSION INHIBITOR TESTING INSIDE A PRODUCTS PIPE LINE.*
Robert H. Meyer.
Corrosion, *15*, No. 3, March 1959, pp. 47–50.

68. MISCELLANEOUS

a. *ANODIC PROTECTIVE COATING ON MAGNESIUM. THE Cr-22 PROCESS—A DEPLETION STUDY.*
R. Wick and M. Reed.
Metal Finishing, *57*, No. 4, April 1959, pp. 68–70.

b. *THE SUPERVISOR AND HIS BOSS.*
Alfred M. Cooper.
Products Finishing, April 1959, pp. 60–74.

c. *MODERN MANAGEMENT METHODS AMD THEIR APPLICATION TO THE SMALLER PLATING SHOP.*
E. A. Ollard.
Electroplating and Metal Finishing, *12*, No. 3, March 1959, pp. 79–83, and April 1959, pp. 134–137.

d. *INCREASED PRODUCTIVITY THRU PROPER WORKER INCENTIVES.*
A. T. Leonard.
Plating Management, April 1959, pp. 9–10.

69. ORGANICS

a. *ORGANIC COATINGS FOR METAL PRODUCTS.*
Robert J. Fabian.
Materials in Design Engineering, *49*, No. 3, March 1959, pp. 113–128.

b. *COATINGS FOR VACUUM METALLIZING ON PLASTICS.*
M. A. Self and John Scharnberg.
Plastics Technology, *5*, No. 3, March 1959, pp. 32–35, 54.

c. *APPLICATION TECHNIQUES, PROPERTIES AND CHEMICAL RESISTANCE OF POLYETHYLENE COATINGS.*
Corrosion, *15*, No. 3, March 1959, pp. 33–36.

d. *THE MECHANISM OF PAINT STRIPPING.*
Dr. S. Spring.
Metal Finishing, April 1959, *57*, No. 4, pp. 63–67.

70. PICKLING

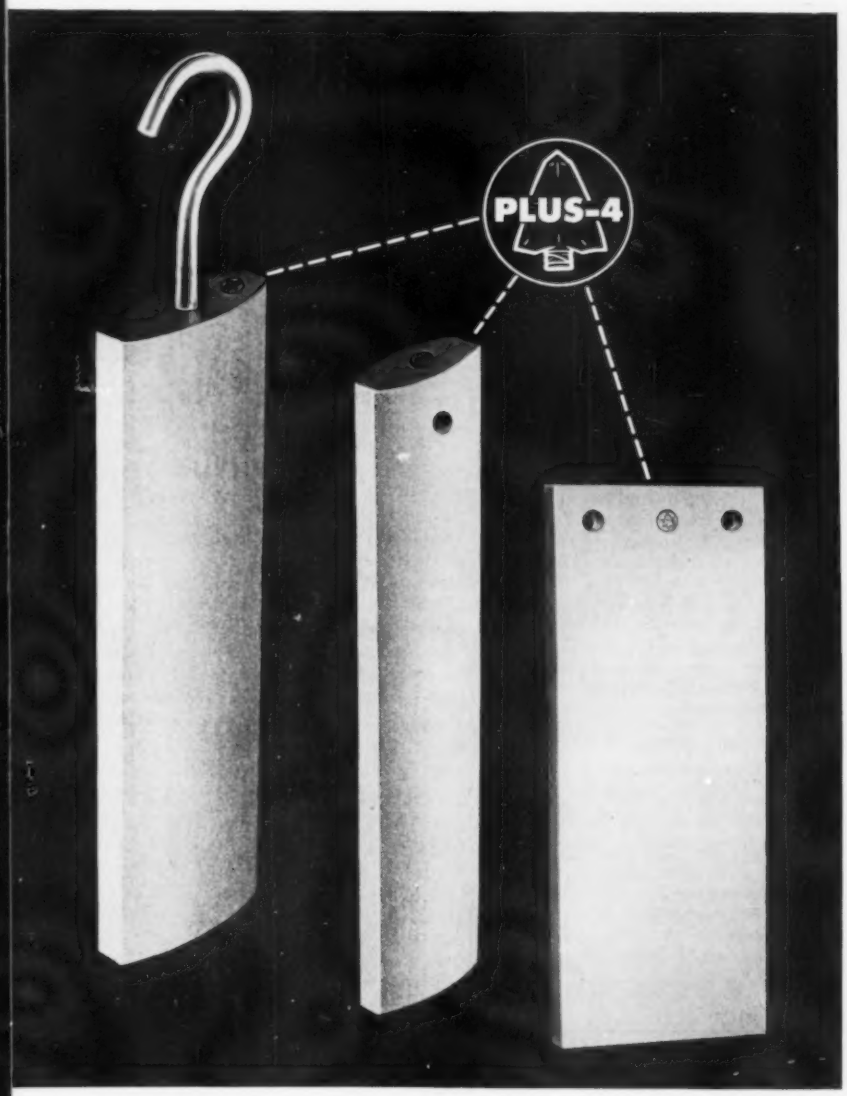
a. *FACTORS INFLUENCING THE RATE-OF-PICKLING TEST ON TINPLATE STEEL.*
R. M. Hudson and G. L. Stragand.
Corrosion, *15*, No. 3, March 1959, pp. 51–56.

71. SAFETY

a. *FIRE HAZARDS IN METAL FINISHING.*
D. J. Fishlock.
Electroplating and Metal Finishing, *12*, No. 3, March 1959, pp. 85–92.

72. WASTE TREATMENT

a. *DIALYSIS FOR SOLUTION TREATMENT IN THE METAL FINISHING INDUSTRY.*
Robert Dvorin.
Metal Finishing, *57*, No. 4, April 1959, pp. 52–54, 62.



The following are metallurgical abstracts taken from *The Journal of the Institute of Metals*.

January 1959, p. 414:

New Protective Silicate Coating for Metals. Otto Loebich (*Werkstoffe u. Korrosion*, 1958, 9, (7), 423–424)—By drying on to metals waterglass soln. and ageing the 0.2-several μ thick silicious film, a protective transparent coating is formed called "Inverron." It protects Ag, Cu and Cu alloys from air corrosion, prevents white rust on Zn, and preserves the surface lustre. It protects against many aq. soln. at room temp., and prevents the scaling of Cu, Fe, and Ni between 150 and 300C. A 5–10 μ coating has a breakdown potential of 220 v. At 400C air passes through and scaling occurs beneath. It will not protect non-noble metals against strong acids or alkalis, nor Fe and steel against flowing-water attack. The chem. nature of the film is described.

March 1959, pp. 541 and 549:

Influence of Electropolishing on the Corrosion of Aluminum in Dilute Solutions of Nitric Acid. Apolonia Malinowska (Przemysl Chem., 1958, 37, 336–338; C. Abs., 52, 16943–16944.)

State of the Surface and the Anodic Potentials of Copper and Nickel During Electrochemical Polishing. N. P. Fedot'ev and S. Ya Grilikhes (Zhur. Priklad. Khim., 1957, 30, (4), 643–645).

Corrosion
National Association of Corrosion Engineers
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No 1 Main St
Houston 2, Texas

Corrosion Technology
Leonard Hill Technical Group
Stratford House
9 Eden St.
London, N.W. 1
England

Electroplating and Metal Finishing
15 Udney Park Rd.
Teddington, Middlesex
England

J. Electrochemical Society
1860 Broadway
New York 23, N. Y.

J. Institute of Metals
17 Belgrave Square
London, S.W. 1, England

Materials in Design Engineering
430 Park Avenue
New York 22, N. Y.

Metal Finishing
381 Broadway
Westwood, N. J.

Plastics Technology
386 Fourth Avenue
New York 16, N. Y.

Plating Management
60 Bently Road
Cedar Grove, N. J.

Products Finishing
431 Main St.
Cincinnati, Ohio

(Continued from page 740)

E—614. Acid Bright Gold—Orosene 999 is described as the first 24Kt acid bright gold ever available.

It produces hard ductile mirror-bright 24Kt gold electroplates in either tank or barrel plating. The unusual quality of hardness with ductility is accomplished by preferred orientation of the gold micro crystals and crystal lattice. This product contains no silver; no antimony; and no sulfur compounds, and it has exceptional tarnish resistance, according to Technic, Inc., its producer. It is also claimed that in barrel plating Orosene 999 offers great throwing power and leveling. Control requires only one addition agent.

E—615. Copper Brightener—Allied Research Products, Inc. has announced the introduction of Isobrite 623 copper addition agent for semi-bright buff cyanide copper plating solutions. It is a "one-shot" brightener which gives the advantage of operating either as a semi or full bright solution depending upon the type of work to be run. It can be used in either rack or barrel plating and is reported to be easily controlled to produce any desired level of brightness by using just the single addition agent.

Over steel, zinc die castings or brass or bronze parts, the brightener produces a copper film that can be bright nickel plated without the need for buffing if the finish of the original material permits.

E—616. Strip Coating—Chemical Consulting service has introduced Strip-Kote a milky colored, concentrated plastic emulsion which when dry is reported to give a transparent, tough film for protecting smooth and wrinkled metal finishes, stainless steel, polished aluminum, etc.

It is applied by brush or spray. The film becomes transparent as it dries. The dried film is said to be permanently flexible.

The emulsion contains no inflammable solvents. The coverage will vary according to the thickness of the dried film deposited. The coverage is 500 sq ft/gal for a 0.004 in. dried film.

E—617. Wet-Blaster—A newly developed automatic wet-blast machine for the removal of light flash and burrs from die-cast name plates and other similar parts has been placed in operation by Hydra-Blast Mfg. This machine features stainless steel construction, no pumps or moving parts in its blast circuit. The new equipment eliminates manual operations. It also incorporates a complete process cycle including automatic un-load and oxidation-inhibition in its final stage.

E—618. Solution Filter—A new rubber lined steel filter for electroplating features a swing-bolt cover to simplify replacing of elements, and a center bottom outlet to facilitate cleaning.

Cover is removed simply by loosening bolts, swinging them out of the way, and lifting cover off. Filter tubes are then accessible for changing.

Bottom outlet allows for quick, easy cleaning of entire vessel, simply by addition of a "T" connection, with drain valve, according to Commercial Filters Corp., the manufacturer.

E—619. Protective Coating—A new coating material has just been introduced by the Howley Chemical Co. Inc. Known as Elastomer No. 614—the coating is basically a one-part allophonate, prepolymerized.

Above average film strength, unusual resistance to chemical attack, high-gloss and capacity for excellent adhesion to an almost limitless variety of surfaces are claimed for this product.

It can be used in brush or dipping processes. The coating is available both clear and colorless as well as pigmented in a variety of colors and can be procured in various degrees of gloss.

E—620. Zinc Paint—Bart Laboratories and Design, Inc. announced the introduction in this country of Galvafroid, a zinc rich paint containing from 92 to 95 per cent of metallic zinc in the dry film, and giving protection comparable to hot-dip galvanizing.

Galvafroid is an English product which has been used extensively in Europe, Africa, Australia and Canada for the last ten years. The paint is being produced for distribution in the United States and its possessions.

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all plastic
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self-priming pump is in the tank

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Get flexible filtration and agitation by . . . (1) Rotating your sump pump while having a filter chamber of the correct size attached to each plating tank. (2) Rotating your filter chamber using an individual sump pump in each tank. (3) Using one sump filter pump for ALL your plating tanks. (4) Using a separate sump filter pump for each tank where continuous filtration is necessary.

Compact, takes little space in tank.

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1. Epoxy pump body and extension assembly with epoxy impeller with Stainless Steel 316, Hastalloy C or Titanium shaft. Epoxy column 10⅛" long.
2. ½ HP Motor, totally enclosed, ball-bearing.
3. Full view high temp. Lucite filter chamber (available in Epoxy) with cotton, dynel, porous stone or porous carbon filter tubes.
4. Unfiltered liquid from pump.
5. Perforated inlet dispersion tube.
6. Filtered liquid return.
7,8 Adjustable sump pump and filter chamber bracket assemblies.
9. Pump and Filter Chamber both supported from flange top of tank.

Sethco
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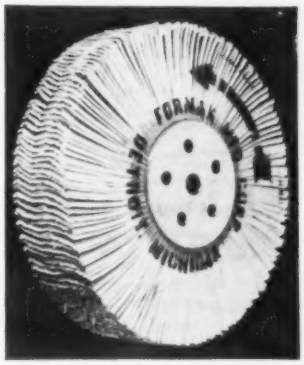
The metallic zinc content, the binders and vehicle used give the product superior corrosion protection characteristics, it was stated. The paint, which can be applied over wet surfaces, is available in several different formulations depending on the method of application and use.



E—621. Buffing Wheel—Formax Manufacturing Corp. has announced the development of a new buffing wheel that is now being marketed under the trade name—"No-Streak Buffing Wheels."

Production users report this new construction, mounted on re-usable flanges, increases normal buff life while providing improved cut and brighter, streak-free finishes.

The manufacturer states such results stem from the fact that the flap-type construction contains more cotton sheeting per square inch of wheel face, holds a better head of compound and is self-cooling. Since extreme pressures are not required to obtain wheel efficiency, buff fraying and compound consumption is reduced.

These wheels are available in all cloth or in cloth and sisal constructions and in diameters from 14 through 22 inches and in 2- through 6-inch face widths.

E—622. Vibrating Separator—A new design principle for more effective screening and separation of barrel-finished parts and abrasive media has been built into a vibrating type separator machine recently introduced by Roto-Finish Co.

A feature of the separator is a vibrating unit which imparts high frequency, low amplitude vibrations to the screening mechanism. This is said to permit faster, more efficient separation and screening of processed parts as well as rescreening of media sizes.

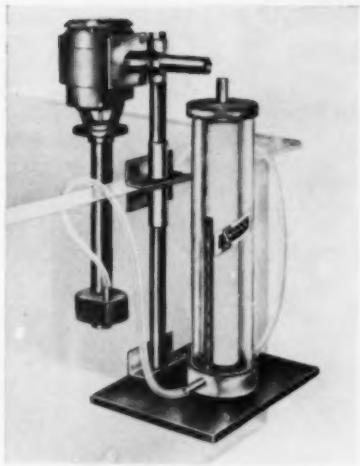
A larger bed, with a screening surface measuring 18 in. wide and 48 in. long, presents a greater work area than that of earlier types and handles a wider range of parts and media sizes and shapes.

It comes equipped with three screens for most standard separating operations and is shock mounted.

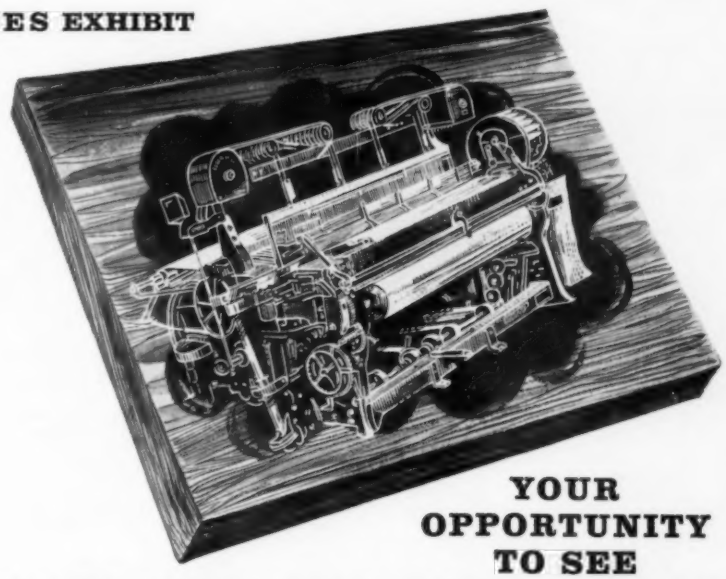
E—623. Sump Filter Pump—A new sump pump filter unit with detachable filter chamber has been developed by the Sethco Manufacturing Corp. This new design provides simplicity and economy of operation by offering flexible filtration and agitation for every type of solution up to temperatures of 250F, according to the manufacturer.

Both pump and filter chamber are said to be easily attached to or detached from the flange top of the tank by means of special supporting bracket assemblies.

The advantages common to both centrifugal and self-priming pumps are retained in this compact unit while their disadvantages are eliminated (the leakage, aeration and double stuffing box care common to the centrifugal types and the short life due to wearing parts common to the self-priming types).



AES EXHIBIT



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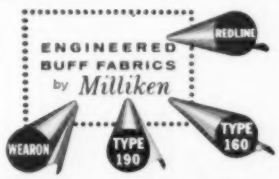

At present we are marketing four different buff cloths —Wearon®, Type 190, Redline and Type 160. Each of these has distinctive operating qualities. We suggest you have trial buffs made up of all four—and be sure to ask for the cloth in the trade mark pattern—so that you can find the cloth best for your needs and then compare its cost/performance ratio with that of the cloth you are now using.

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TRADE LITERATURE

L—601. Heat Transfer and Immersion Firing—The subject of heat transfer, by radiation, by conduction, and convection, is handled in one of two new bulletins published by Sellers Engineering Co.

Also covered are the problems involved in the transmission of heat from a hot gas through a metal surface into water. In addition there is a special section headed "Miscellany".

In the second of the series Sellers gives a detailed report on the subject of immersion heating.

Covered, too, is the action of immersion firing in overcoming the heat-flow resistance of dead gas film which clings to heating surfaces.

L—602. Room Temperature Cleaner—Savings made possible by the cleaning of metals with Oakite Room-Temp Cleaner are described in a folder F10596 recently published by Oakite Products, Inc.

Designed primarily for use in spray washing machines, the compound is most frequently used in the temperature range of 80 to 100F. At such temperatures, washing solutions require considerably less expensive heating it is claimed, and there is less loss of heat through absorption by the metal being processed. There is a similar saving in air conditioning costs, as well, since conditioning equipment has less heat to counteract. Working conditions are improved.

The booklet points out other advantages of the material: its long life in solution; its ability to retard rusting of steel between operations; its safety on steel aluminum, copper, brass, and zinc, and their alloys; its versatility in application.

L—603. Finishing Systems and Price Guide—Allied Research Products, Inc. has issued a new data file covering its line of process engineered equipment and systems for metal finishing.

The new equipment file describes the "turnkey" plan for specialized finishing service offered by Allied, as well as specific items of equipment. The specialized finishing service is a new facility making available one-source engineering, installation and service for complete finishing systems on a "turnkey" basis.

At the same time, Allied has announced the issuance of its new price guide which lists current prices on process chemicals and supplies. This covers a wide range of commodity chemicals, anodes and supplies.

L—604. Degreasers and Ovens—Baron Industries has announced the publication of a new, fully illustrated facilities and equipment catalog No. 10M359. Contents include photos, drawings and complete specifications of the firm's line of standard degreasers and ovens that are fully assembled for shipment and installation. In addition, there is included photographic examples of special metal cleaning and heat processing units individually created to meet specific industrial requirements.

L—605. Media Bins and Pans—New bins and pans designed for the convenient storage and handling of all barrel finishing media are described in Bulletin No. 401 just released by Techline Division of Wheelabrator Corp.

Included in the two-page bulletin are complete specifications, line drawings and illustrations to describe Techline's new media bins and media pans. The bulletin also employs brief explanations to outline how the installation of the bins and pans can save time and labor in the finishing department operation.

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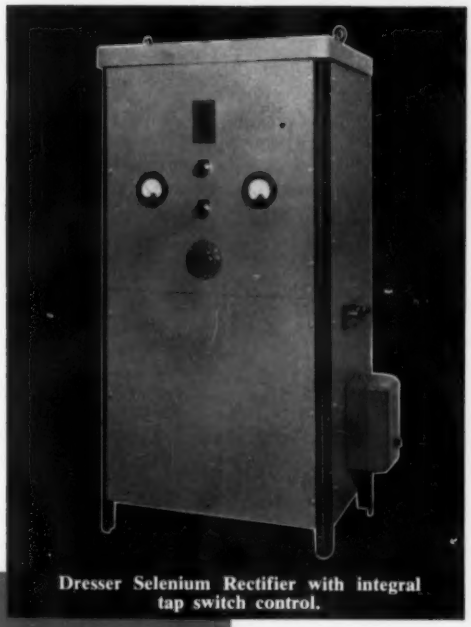

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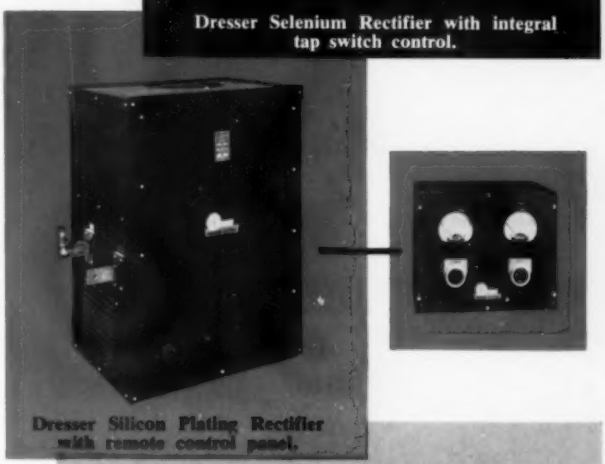
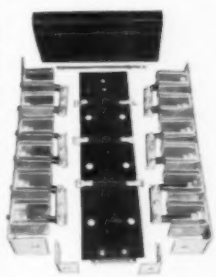


Dresser Silicon Plating Rectifier with remote control panel.

Bench-type Dresser Selenium Rectifier with continuous manual voltage adjustment.



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PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,862,841, 12/2/58—Treatment of Steel for Enameling—L. Bernick, *et al*, assignors to Inland Steel Co., Chicago, Ill.

Prior to a single cover coat of enamel, coat the iron or steel article with certain oxides (Ti, Sb, W) then heat in non-oxidizing atmosphere.

See also No. 2,862,842 describing the use of molybdenum oxide in 22 claims.

22 claims.

No. 2,862,860, 12/2/58—Cadmium Electroplating—P. Vlannes, Fort Washington Forest, Md. and S. Strauss and Benjamin F. Brown, Washington, D. C.

The deposition of cadmium from a cyanide-free electrolyte is described. A cadmium salt is dissolved in a solution containing a monoamino-monocarboxylic acid of 2 to 5 carbon atoms. Reduction of hydrogen embrittlement is claimed. Using glycine 170 g are needed for 305 g of 3 $CdSO_4.8H_2O$ and the *p*H should be 9 to 10.

8 claims.

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Write for Bulletin 97
SPRAYING SYSTEMS CO.
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No. 2,862,861, 12/2/58—Copper Cyanide Plating—P. Moy assignor to the Harshaw Chemical Co., Cleveland, Ohio.

A cyanide copper solution is described which contains as an addition agent a thio-substituted six member heterocyclic ring compound. Examples of the addition agent, which may be present in the amount of 0.05 to 10 g/l, are dithioammelide, thioammeline, 2, 6 diamino—2 mercapto pyrimidine.

11 claims.

No. 2,863,791, 12/9/58—Oxalate Coatings—P. de Cerma, assignor to Montecatini, Italy.

Oxalate coatings can be laid down on iron and steel by immersing in an aqueous solution of oxalic acid and sodium nitrite with the nitrite concentration being maintained between 0.2 and 4 g/l.

4 claims.

No. 2,863,792, 12/9/58—Scale Removal from Alloy Steel—H. Todd, assignor to Superweld Corp., North Hollywood, Calif.

Before normalizing alloy steels coat with an alkali salt composition (5–10 per cent TSP, 10 per cent soda ash, 5 per cent $NaNO_2$, wetting agent, iso-propyl alcohol and water) which will react with the acidic metal oxides in the furnace to form compounds soluble in acid.

9 claims.

No. 2,863,793, 12/9/58—Phosphating Bath—P. de Cerma assignor to Montecatini, Italy.

This patent describes a method for maintaining the efficiency of room temperature phosphating baths by employing feed salts at a ratio different than that of the bath.

4 claims.

No. 2,863,810, 12/9/58—Electrowinning Zinc—J. Henderson and H. Montague, assignors to American Smelting and Refining Co., N. Y., N. Y.

An improvement in zinc electrowinning consects of coating the anodes with manganese dioxide prior to electrolysis.

4 claims.

No. 2,864,730, 12/16/58—Protecting Magnesium—D. Kinder and Ray Stricklin, assignors to Allied Research Products, Inc., Baltimore, Md.

Claim I reads: "A composition for use in aqueous solution to impart a protective coating to magnesium and magnesium alloy articles consisting essentially of a hexavalent chromium compound selected from the group consisting of chromic acid and salts thereof in amount of about 14 to 37 per cent, a nitrogen-containing compound selected from the group consisting of nitric acid and salts thereof in amount of about 32 to 70 per cent, and a chloride compound selected from the group consisting of hydrochloric acid and salts thereof in amount of about 4 to 50 per cent, the foregoing per cent ranges being calculated on the basis of the total weight of active ions present in an aqueous solution containing said composition and having a *p*H of from about 0.0 to 2.0."

No. 2,864,731, 12/16/58—Protective Films for Metals—D. Gurinsky *et al*, assignors to USA (AEC)

To inhibit the corrosion of ferrous metal surfaces by heavy liquid metals at temperatures about 500C can be accomplished by bringing zirconium and nitrogen in reactive contact to form a zirconium in the liquid metal.

19 claims.

No. 2,864,732, 12/16/58—Coating Titanium—R. Miller and R. Jefferys, assignors to Battelle Development Corp., Columbus, Ohio.

Claim I states: "A composite article comprising a basis material selected from the group containing titanium and titanium-base alloys, and a coating on the surface of said basis material, said coating consisting essentially of a major proportion of chemically combined titanium, at least one metal selected from the group consisting of the alkali metals and the alkaline earth metals, and at least one halide, and a minor proportion of a non-metallic radical selected from the group consisting of phosphate, borate, oxalate, citrate, and tartrate."

No. 2,864,733, 12/16/58—Zinc-Tin Solder for Aluminum—F. Kranich, Chicago, Ill.

A zinc-tin solder (9:11 parts, respectively) along with 1 part of an alloy consisting of silicon, copper and silver (20 per cent Si) is claimed.

10 claims.

No. 2,865,125, 12/23/58—Apparatus for Selectively Contouring a Metal Part by Etching—W. Langsfeld, assignor to Turco Products, Inc., Los Angeles, Calif.

An apparatus for controlling the rate of movement of an object into and out of an etching solution for contouring the surface of said object is described.

7 claims.

No. 2,865,145, 12/23/58—Degreaser—I. Lans, assignor to Metalwash Machinery Co., Elizabeth, N. J.

An apparatus including tank, carrier basket and guide means to move the basket along a vertical path and a means for rotating said basket is claimed.

8 claims.

No. 2,865,823, 12/23/58—Reclaiming Pickle Liquor—A. Harris and C. Stricker, assignors to U. S. Steel Corp., New Jersey.

Waste hydrochloric acid pickle liquor is treated with hydrogen chloride gas to raise the HCl concentration to 20–25 per cent, then the solution is cooled and the ferrous chloride is separated from the liquor. The crystals are dissolved in water and electrolyzed in a cell separated by an anconic membrane to deposit iron on the cathode and chlorine at the anode. The chlorine is treated with hydrogen to form hydrogen chloride which is recycled.

6 claims.

No. 2,865,830, 12/23/58—Production of Sheet Metal by Electrodeposition—J. J. Zoldar, assignor to The Anaconda Co., New York, N. Y.

A drum method for depositing sheet metal, especially copper, is described. The improvement concerns the use of solution agitation by flow instead of air agitation of the bath.

5 claims, 3 figures.

No. 2,865,831, 12/23/58—Electroplating Machine—N. Ransohoff, assignor to N. Ransohoff, Inc., Hamilton, Ohio.

A plating barrel is described in which anode fragments are held in a basket within the barrel.

14 claims, 15 figures.

No. 2,865,832, 12/23/58—Electrolytic Dissolution of Stainless Steel—E. Pitzer, assignor to USA (AES)

An apparatus is described for electrolytically dissolving radioactive stainless steel elements in nitric acid.

5 claims.

No. 2,865,971, 12/23/58—Nitride Coating Process—W. Ruppert and G. Schwedler, assignors to Metallgesellshaft Aktiengesellschaff, Frankfurt au Main, Germany.

(*Continued on page 754*)

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AES RESEARCH PROJECTS: FROM BIRTH TO DATE

PROGRAM'S PHASE NO. 1. (1929-1944)

The Spotting of Plated or Finished Metals—National Bureau of Standards—(Concluded 1929)

Throwing Power in Chromium Plating—National Bureau of Standards—(Concluded 1929)

The Porosity of Electroplated Chromium Coatings—National Bureau of Standards—(Concluded 1931)

Protective Value of Nickel and Chromium Plating on Steel—National Bureau of Standards—(Concluded 1934)

Accelerated Tests of Nickel and Chromium Plating on Steel—National Bureau of Standards—(Concluded 1934)

Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel—National Bureau of Standards—(Concluded 1935)

Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals—National Bureau of Standards—(Concluded 1940)

Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings—(Concluded 1944)

PROGRAM'S PHASE NO. 2. (1944-1959)

Project No. 1. "Stripping of Copper from Various Base Metals," Indiana University (1945–1947) Last phase conducted at National Bureau of Standards

Project No. 2. "Determination of Impurities and Major Constituents in Electroplating Solutions and Analysis of Cyanides in Plating Room Wastes," Lehigh University and Princeton University (1944–1955)

Project No. 3. "Adhesion of Electrodeposits," University of Michigan (1945–1947)

Project No. 4. "The Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings," U. S. Time Corporation (1947–1954)

Project No. 5. "The Effect of Impurities and Purification of Nickel Plating Solutions," Michigan State University (1945–1957)

Project No. 6. "Porosity of Electrodeposited Metals," Princeton University (1946–1954)

Project No. 7. "Methods of Testing Thickness of Electrodeposits," Pennsylvania State University (1945–1951)

Project No. 8. "Polarization and Overvoltage," Cleveland Graphite Bronze Co., Division of Clevite Corp. (1946–1952)

Project No. 9. "Physical Properties of Electrodeposited Metals—Nickel," National Bureau of Standards (1947–1952)

Project No. 10. "Disposal of Plating Room Wastes," Yale University (1955–1957)

Project No. 11. "Current and Metal Distribution in Electrodeposition," Evansville College (1948–1952)

Project No. 12. "Cleaning and Preparation of Metals for Electroplating," Columbia University—Current (1948–To Date)

Project No. 13. "The Nature, Cause and Effect of the Porosity in Electrodeposits," National Bureau of Standards—Current (1950–To Date)

Project No. 14. "The Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating," Ontario Research Foundation—Current (1951–To Date)

Project No. 15. "Accelerated Corrosion Tests"—Current (1952–To Date)

Project No. 16. "Mechanism of Electrodeposition," University of Pennsylvania—Current (1955–To Date)

Project No. 17. "Microthrowing Power," Virginia Institute for Scientific Research—Current (1955–To Date)

Project No. 18. "The Mechanical Finishing of Metal Surfaces," National Lock Company—Current (1955–To Date)

(Only those Research Project Serial Reports listed on page 767 are available, all others are out of print.)

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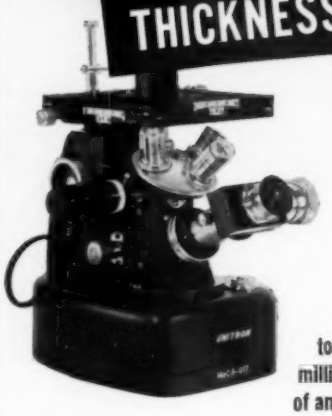

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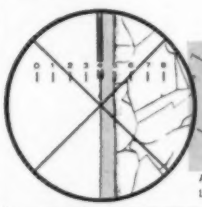

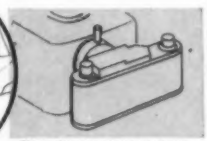

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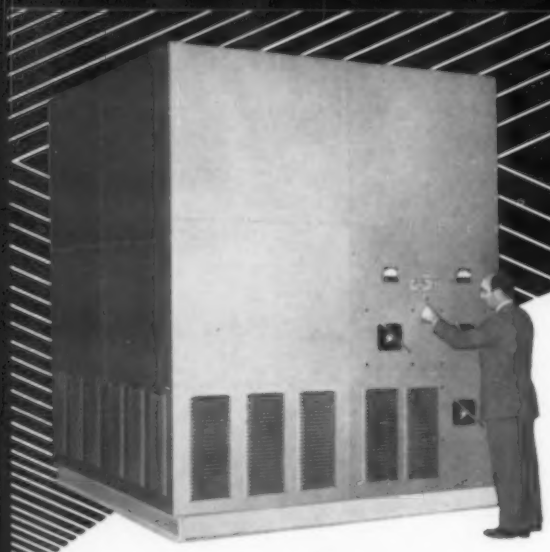

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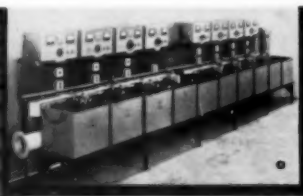

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(*Continued from page 749*)

To deposit titanium nitride on surfaces introduce titanium halide and ammonia in a nitriding zone adjacent to surfaces to be coated at a temperature above the decomposition temperature of the complex compounds of ammonia with the titanium halide.

5 claims.

No. 2,799,633 (Reissue No. 24,582 dated 12/28/58)—Bright Gold—E. Rinker assignor to Sel-Rex Corp., Belleville, N. J.

This is a reissue of the bright gold patent describing the use of silver cyanide as a brightener, present in the amount of 0.1 to 2 per cent (as silver) to potassium gold cyanide (as gold).

14 claims.

No. 2,866,740, 12/30/58—Plating Rhodium—F. Reid, Hounslow England, assignor to International Nickel Co., New York, N. Y.

Crack-free rhodium deposits are obtained from acid baths containing 0.05 to 25 g/l of selenic acid (or alkali salts thereof).

9 claims.

No. 2,867,062, 1/6/59—Pleated Buffing Wheel—F. Hendrickson, Elgin, Ill.

Claim I reads: "In a buffing wheel, a circular hub having an axial opening therein for mounting on a shaft, mutually spaced spokes extending outwardly radially from the periphery of said hub, a buffing annulus on said hub having a peripheral work surface and comprised of a plurality of multi-ply elements of fabric material carried by said spokes, a medial pleat in each element, said elements each being folded along a line perpendicular to the pleat therein so as to define a semi-circular shape having a greater number of material thickness in its medial pleated portion than at its end portions, mounting brackets one seated in the fold of each element and each having integral leg portions extending through the material at the fold, said leg portions overlying the related spoke and being secured thereto to hold the element in place, said spokes being peripherally spaced to permit the end portions of adjacent elements to overlap one another to afford a material thickness in the peripheral work surface of said overlapped portion that is substantially the same as the thickness of the peripheral work surface of the medial pleated portions of said elements."

2 claims.

No. 2,867,225, 1/6/59—Degreaser—E. Zademach *et al*, assignors to Metalwash Machinery Co., Elizabeth, N. J.

A vapor degreaser is described.

25 claims, figure.

No. 2,867,514, 1/6/59—Aluminum Deoxidant—N. Newhard and James Thrisk, assignors to Amchem Products, Ambler, Pa.

A method of treating an aluminum surface which consists of subjecting the surface to the action of an aqueous solution consisting essentially of hexavalent chromium and fluoride between CrO_3 30 g/l and H F (48.8 per cent) 0.25 ml in 1 liter of water and CrO_3 30 g/l and H F 1 ml/l.

4 claims.

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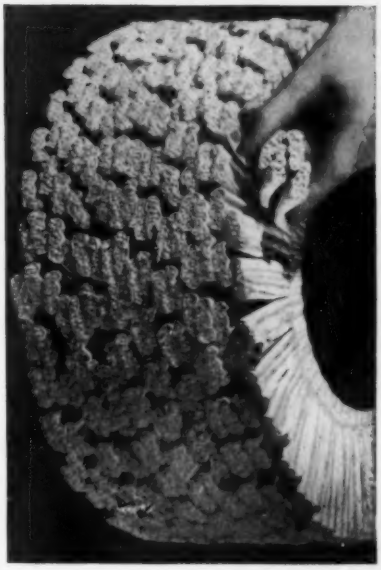

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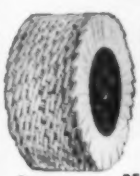

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PERSONALS

Arthur R. Dammkoehler has been added to the midwest sales staff of Sel-Rex Corporation. During the past six months, Sel-Rex has added direct representation and sales offices in the west, middle Atlantic states and in New England, and is expected to announce shortly the establishment of a manufacturing division, with its own autonomous sales set-up, for European operations.

Mr. Dammkoehler, who will headquarter at Sel-Rex's Chicago office, located at 5875 North Lincoln, holds a degree in mechanical engineering from the Illinois Institute of Technology. He brings nearly a decade of technical experience in the fields of electroplating and metal finishing to his new post having held positions with Underwriter's Laboratories, Cook Research Laboratories and Taylor Forge and Pipe Works. Mr. Dammkoehler was also employed by Belke Manufacturing Company for seven years as managing engineer of the electroplating equipment department.

A. R. Dammkoehler

P. Veit

Peter Veit has been promoted to field service engineer by Enthone, Inc., a subsidiary of American Smelting and Refining Co. He will augment the technical staff of the Enthonics Laboratories.

Mr. Veit joined Enthone in 1956 as district sales engineer for metropolitan New York City. Prior to that he was associated with Oakite Products, Inc. as technical service engineer and with Grumman Aircraft Corp. as a production engineer. He is a chemical engineering graduate of Brooklyn Polytechnic Institute.

Carmen J. Pedalino has joined Enthone. He has been assigned to the engineering staff of Enthone's equipment department.

Mr. Pedalino received his BSc degree in industrial engineering from the University of Bridgeport, Bridgeport, Conn. and also attended Hillyer College in Hartford, Conn. He was with the engineering department of Wallingford Steel Co., Wallingford, Conn.

A. J. Hebsacker has been moved up to regional supervisor in the Chemical Processing Division of Detrex Chemical Industries, Inc.

Mr. Hebsacker has spent the last 19 years in the field of chemical processing. In his new assignment, he and his staff will cover the states of Michigan and Indiana.

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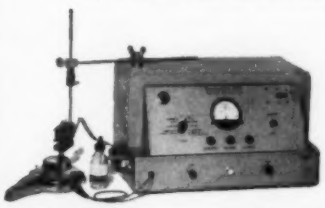

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- Increases plating speeds from 50% to 200%
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Tensile Strength	41,000 psi	33,000 psi
Elongation in 2 in.	23%	16%
Rockwell "F" Scale	75	66
Ductility	4 bends on itself	2 bends on itself

(Thickness of copper specimens tested was 0.033")

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S. E. Beauregard

A. Nash

Stanley E. Beauregard has joined the sales staff of R. O. Hull & Co., Inc. He brings with him 15 years experience in all phases of metal finishing, the past five years having been served as sales engineer.

Mr. Beauregard will operate from Detroit office and serve eastern Michigan industries.

Arno Nash has been named vice president and general manager of the Radio Receptor Selenium Division of General Instrument Corp. A specialist in the selenium semi-conductor field, Mr. Nash formerly was eastern regional manager for International Rectifier Corp.

In his new post he will be in complete charge of operations for the Selenium Division of Radio Receptor. I. B. Seidler, who formerly occupied this post, has resigned to become vice president of Kensington Capital Corp.

Mr. Nash will make his headquarters at the General Instrument subsidiary's Brooklyn, N. Y. plant, where the company has set up special automatic processes and equipment for mass production for the first time in the United States of a new type of smaller, lighter, less expensive selenium rectifier, as U. S. licensee of Siemens of West Germany.

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W. Finley Jr. has been appointed chief chemist of Apex Alkali Products Co. of Philadelphia. He was born in Philadelphia in 1919, and is a graduate of Episcopal Academy. He attended the University of Pennsylvania from 1937 to 1940 and obtained his BS degree in chemistry from Villanova College in 1942. Before coming to Apex, he was associated with the International Chemical Co. of Philadelphia from 1937, where he was engaged in research and development in industrial lubricants and cleaning compounds.

Perry C. Burnham has been named district manager of Hanson-Van Winkle-Munning Co., J. C. Miller Division, Grand Rapids. His new territory includes Western Michigan, the state of Indiana, and Northern Ohio (except Toledo).

Mr. Burnham, a native of Grand Rapids, has been associated with H-VW-M since its merger with the J. C. Miller Co. in 1954. Following the merger, Mr. Burnham, a metal finishing engineer, specialized in sales and engineering for H-VW-M's line of full automatic processing conveyors. He joined J. C. Miller in 1948.

Mr. Burnham, a veteran of World War II, is an active member in the American Electroplaters' Society and a past president of its Grand Rapids Branch.

James A. Badaluco remains as vice president and will continue to specialize in compound and buff sales nationally with headquarters in Grand Rapids. **Walter R. Lockwood,** sales representative, will continue to maintain his office in Anderson, Indiana.

P. C. Burnham

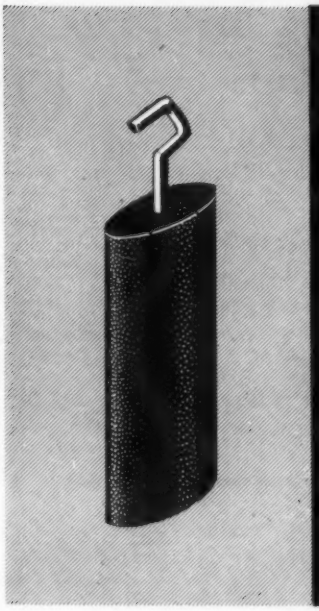
E. O. Eagle

Eugene O. Eagle will distribute products manufactured by the Schaffner Mfg. Co., in the states of Virginia, North Carolina, and South Carolina.

Mr. Eagle has been in the metal finishing field for many years. His experiences have been in buffing, polishing and the cleaning of metals.

He makes his home at 302 S. Tremont Drive, Greensboro, N. C.

F. L. Dailey, a development engineer in the Product Development Department of Diamond Alkali Co., has been promoted to assistant manager, Industrial Chemicals.



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(Tru-Cast)
Cast 95-97%

The rolled depolarized type is available in elliptical, round, or flat form. Other Ahco Nickel Anodes are available in elliptical form only.* All are available in various lengths.

**Cast 95-97% may be cast in various shapes.*

CADMIUM, ZINC, COPPER, BRASS, TIN

All of these Ahco Anodes are available in ball or oval form.* In most cases flat-top and other special shapes may also be obtained.

**Copper Anodes are available both rolled and cast.*

. . . and many other types for special applications, plus a complete line of plating chemicals

The quality of all Ahco Anodes is laboratory controlled to assure superior performance every time. And your Ahco Field Engineer is always ready to help you get the most from these outstanding products . . . be sure to ask him about the *Ahco Nickel Recasting Service.*

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Frederick Gumm Chemical Company
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Industrial Chemical & Equipment Co.
205 Eleventh Avenue South
Minneapolis, Minnesota

Wm. Buchanan Supply Company
6314 Wiehe Road, Golf Manor
Cincinnati, Ohio

Empire Electro Plating Supplies Corp.
69 Murray Street
New York, New York

Harstan Chemical Corporation
1247-38th Street
Brooklyn, New York

A. A. Merz
153 Centre Street
New York, New York

Carmac Chemical Company
1015 Peralta Street
Pittsburgh 12, Pennsylvania

Austin F. Fletcher, Inc.
Box 536
Binghamton, New York

Haviland Products
421 Ann Street N.W.
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Baltimore, Maryland

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Mr. Dailey started with Diamond in November 1953, as a product development specialist in the Research Department. Associated with the field development programs involving Diamond's new organic chemicals, Dailey supervised the recent sales development program for the new chlorinated xylene chemicals.

He is a graduate of Lafayette College, Easton, Pennsylvania, where he earned his BS degree in chemical engineering in 1938. He has worked in the chemical industry for twenty years as a chemist, chemical engineer, plant supervisor and sales engineer.

He holds membership in the American Chemical Society, the Cleveland Section of the AIChE and is publications committee chairman of the Commercial Chemical Development Association.

R. W. Huffman

C. Riley

Robert W. Huffman has been elected president and general manager of Solventol Chemical Products, Inc. He succeeds M. Howard Downs who has resigned to accept a position with Downs & Wiles, Wabash, Ind. Mr. Huffman has been executive vice president of the company.

Clay Riley has been appointed director of technical service of Industrial Filter and Pump Manufacturing Co.

A member of the company three years, Mr. Riley started as a research engineer. He is a graduate of Rose Polytechnic Institute from where he received his BS degree in electrical engineering in 1942.

His previous experience was gained at Hardy Manufacturing Co. in Union City, Indiana as plant engineer and at Diamond Chain Co., Indianapolis, as a maintenance foreman. He served three years in the Engineer Corp of the Army as a lieutenant during World War II in the European Theatre.

Robert B. Lamkin and **William E. Schwartz** have been elected president and vice president (Engineering and Development) respectively of Chandeysson Electric Co. Mr. Lamkin formerly represented Chandeysson in the steel industry.

TECHNICAL PROCEEDINGS AWAITING YOUR ORDER

CONTAINING each of the technical papers delivered before the AES's 45th Annual Convention held in Cincinnati, Ohio, May 19-22, 1958, together with their charts, diagrams, graphs, tables and other illustrations, and with the verbatim discussion that followed their delivery, TECHNICAL PROCEEDINGS (1958 Edition) broadly enriches technical and scientific knowledge in the field of electroplating, metal finishing and allied arts.

It also includes the stenotype report of the panel session on "Practical Plating Problems" that was a hit of that Convention.

A larger book than the 1957 edition, it also carries a front section that includes a complete chronological list of AES Conventions and Past Presidents; a day-to-day log of the 45th Annual Convention; a section on the AES Scientific Achievement Award and on the Paper Awards presented at that convention; a full listing of AES's 1958-1959 Boards and Standing and Special Committees and a complete Branch Directory up to date as at September 1, 1958.

The domestic price of the 1958 Edition of TECHNICAL PROCEEDINGS is $12 per copy including postage. To those ordering from outside of the United States' continental limits, the charge is $15 per copy including postage. All orders must be accompanied by payment in full. Address orders and make checks payable to:

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A limited quantity also exists of the 1956 book at $12.50 per copy domestic; $15 per copy foreign and of the 1957 book at $10 per copy domestic and $12.50 per copy foreign. All orders must be accompanied by payment in full.

MARVIN J. UDY

Marvin J. Udy, 67, prominent metallurgist and science pioneer, died of a heart attack April 11 at Niagara Falls, N. Y. Mr. Udy, who developed the first commercial processes for refining and utilizing chromium, was vice president and consultant for Strategic-Udy Processes, Inc.

Born in Utah, he lived in Niagara Falls the last 40 years. He received Bachelor and Master degrees in science from the University of Utah where he was a research fellow for the U. S. Bureau of Mines.

In 1956 he received an honorary degree from Alfred University. He also was winner of the 1948 Schoellkopf Science Medal. Surviving are his widow and a son.

ALEXANDER N. BRAUN

New York Branch of the AES lost one of its most active and well-known members in the death of Alexander N. Braun. Mr. Braun died suddenly on May 2 of a heart attack at his home in New York City. He was 67.

Mr. Braun began his career in organic finishing in the Chicago area, when he joined G. J. Nikolas and Co. just 40 years ago. He terminated this connection to become a founder of Agate Lacquer Manufacturing Co., Long Island City, N. Y., in 1925, and was its president for some 25 years. About eight years ago, he organized his own firm, Braun Organic Finishes, Inc., of Long Island City.

Mr. Braun was a member of the Board of Managers of New York Branch for many years. He was a past president of the Metal Finishing Suppliers' Association.

He is survived by his wife, Ethel R., a brother and three sisters. His daughter and son died in 1944 and 1945.

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Because of the unique design, the current carrying capacity is almost unlimited. The standard size is 3/4" diameter and designed to carry 250 AMPS each. These splines can be made to carry up to 5000 AMPS per spline if requested. All parts including the spline itself are made of pure titanium.

Racks can be made by the use of two or more splines by attaching rigid titanium connections. Its versatility is unlimited.

Our latest booklet lists the numerous titanium Spline and Rack accessories available. Also listed are the nuts, bolts, studs and washers currently in production. Prices will be furnished on request.

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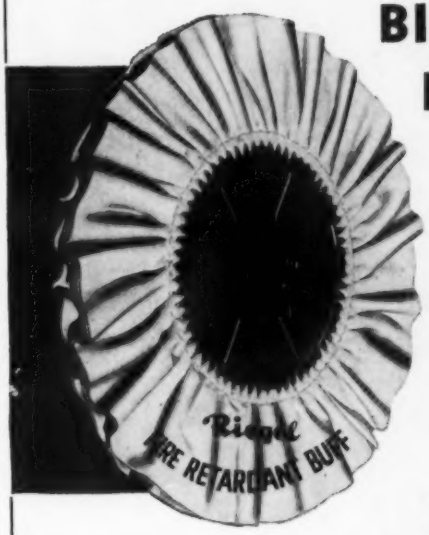

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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, May 1, 1959 — 58.

(1) Boston Annual Technical Meeting participants, left to right, George Marotta, educational chairman; Edwin F. Ottens, William K. Murray and Dr. Abraham M. Max, speakers. (2) Part of the well-attended Technical Session. (3) Big crowd at the evening banquet.

BOSTON ANNUAL A GOLDEN JUBILEE CELEBRATION

The AES Boston Branch held its twenty-third annual technical meeting and banquet at the Hotel Statler in Boston, Massachusetts, on Saturday, May 2 with a fine attendance of members, guests and their ladies. In honor of the AES Golden Jubilee, Boston Branch displayed the Society's Golden Jubilee banner at the afternoon meeting and at the banquet in the evening, and the occasion was also marked by the gold cover on the programs.

Three speakers were presented at the technical session by Educational Chairman George Marotta. Dr. Abraham M. Max, manager of the Chemical and Physical Laboratory, Engineering and Development Section of the RCA Victor Record Division, Indianapolis, spoke on "Contributions of Plating to Hi-Fi Records." His presentation included a movie in sound and color of a recording by the Boston Symphony Orchestra. "Printed Circuit Manufacture" received thorough treatment by Edwin F. Ottens, of the Philco Corp., Philadelphia. In his illustrated talk, "Solving Problems in Electroplating," William K. Murray, manager of marketing, Enthone, Inc., touched upon a wide variety of difficulties which electroplaters might encounter and supplied practical information for their detection and solution.

While the men were attending the technical session, the ladies were treated to a Cinerama theatre party to see "South Sea Adventure." Nearly 500 banqueteers filled the ballroom in the evening. The National Society was represented by the National Second Vice President W. Andrew Wesley and National Executive Secretary John P. Nichols. General Chairman F. Wayne Martin and Louis Gagnon distributed the many prizes contributed by generous suppliers. Entertainment and dancing added to the enjoyment of the evening. Visitors were present from Detroit, Newark, Hartford, Philadelphia, Southern Tier, Providence-Attleboro, Springfield and other AES Branches.

BRITISH COLUMBIA

Support Per Capita Increases; Dr. Saltonstall Presents Paper

There were 30 members and guests at the General Meeting of the British Columbia Branch held on April 3 at the White Spot Dining Room.

President **Jim Lee** introduced **Jack Hagman** of the Weiser Lock Co. of Canada Limited, one of our guests for the evening. A new member was welcomed.

Once again there was a discussion on the problem of our Night School Electroplating course and it was decided that a questionnaire should be mailed to various interested industries in order to ascertain the interest in a possible night school course next fall.

A letter was read by our president from the Baltimore-Washington Branch requesting our Branch support for A. G. Pierdon as a member of the Executive Board of the Supreme Society. The recommendation of the B.C. Branch executive was that we give Mr. Pierdon our backing. A motion to give our full support to his election was carried.

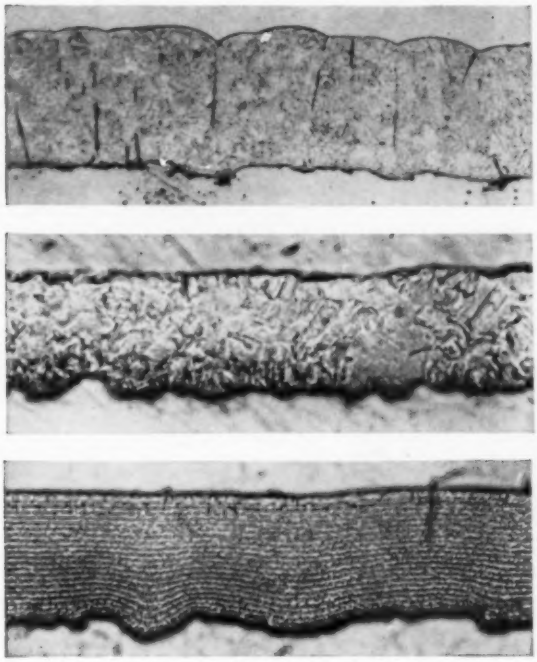
Jim Lee read a letter from the Baltimore-Washington Branch requesting our support in a move to raise the per capita tax from the present $5.70 to $10.00 per year, at the June Supreme Society meeting. After some discussion on this matter a motion was passed to support the proposed increase.

After the business session, President Jim Lee introduced our guest and speaker **Dr. R. B. Saltonstall,** technical director of the Udylite Corp. Dr. Saltonstall's topic was "The Role of Agitation in Electroplating." He opened his paper by describing the various methods of agitation, such as, cathode rod movement, the gassing effect produced in electrolytic solutions, solution circulation using pumps, mixers etc., and finally the use of air. He touched on the use of agitation in cleaning, rinsing, electropolishing, purification of plating solutions and the use of agitation in plating solutions during operation. Dr. Saltonstall told us of many of the advantages produced by agitation. His talk was illustrated by a short movie film showing experimental work which was done involving the study of patterns of

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

New Du Pont process deposits level coat of protective copper on metal parts



Three photomicrographs show a 0.001-inch thickness of copper plated on polished steel of 24 RMS (750 magnification)

1. Conventional copper plating

Note the columnar structure and the uneven copper surface you get with conventional copper plating using direct current.

2. Du Pont process—interrupted current

Note the amorphous structure and the relatively level copper surface you get with Du Pont's process. Interrupted current is used where maximum leveling is not required.

3. Du Pont process—current reversal

Note the laminar structure and the extremely level copper surface obtained with Du Pont's process. Current reversal is used where maximum leveling is required.

Du Pont's Leveled Copper Process gives you lower finishing costs... improved appearance of plated parts . . . better corrosion resistance

Du Pont research has found a way to cover the "peaks and valleys" of metal surfaces with a uniform coat of protective copper—during the plating process. Here are the advantages:

For plating on zinc die castings:

1. Covers minor imperfections
2. High reflectivity
3. Excellent hiding power
4. Good corrosion resistance
5. More uniform plate distribution because of high throwing power

For plating on polished steel:

1. Levels peaks and valleys of polish marks
2. Superior corrosion resistance
3. More uniform plate distribution because of high throwing power
4. Less buffing required
5. Lower over-all finishing costs

VISIT THE DU PONT EXHIBIT AT THE A.E.S. PLATING SHOW, June 15-19, in Detroit, Booths 144-A and 145-A. Du Pont's new plating process will be featured along with these new plating products:

ALL-PURPOSE "CYANOBRIK" SODIUM CYANIDE
NEW "CYANOGRAN" M SODIUM CYANIDE
NEW POTASSIUM-COPPER CYANIDE DOUBLE SALT
SODIUM-COPPER CYANIDE DOUBLE SALT

A combination of unique chemical additives and current variations is the basis of Du Pont's leveled copper-plating process:

1. A high efficiency cyanide copper bath
2. Special Du Pont addition agents, Elchem 1396 and Elchem 1442M
3. a. Interrupted or direct current where maximum leveling is not required or . . . b. Current reversal (for maximum leveling), 60-second plating, 20-second deplating
4. Agitated electrolyte

Du Pont's leveled copper plating can be adapted to most plating operations easily, quickly and inexpensively. Contact your nearest Du Pont District Office for information on how you can save money and time—improve your finished product.

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air bubble flow in an air agitated solution. When Dr. Saltonstall had finished, he was good enough to take part in an extremely lively question and answer period which lasted for well over an hour. It was indeed a very interesting and informative evening.

Nelson A. Shepherd
Secretary

CENTRAL MICHIGAN
Lancy Talks on Waste Treatment

Central Michigan Branch met for a combined dinner and educational meeting on Tuesday evening, April 7, at the Roosevelt Hotel in Lansing, Michigan, with an attendance of 32 members and guests.

President **K. R. Haworth** called the meeting to order following dinner. Final plans for the Ladies' Night Party to be held May 5, were announced. The matter of an increase in the proposed per capita tax to $10 from the present $5.70 was discussed. The membership voted to instruct the Branch delegates to the annual convention to cast "no" votes for such an increase but to use judgment concerning any lesser increase based on full facts and convention discussion.

Harry Anderson, librarian, introduced the evening's speaker, **Dr. Leslie E. Lancy,** consulting engineer, who presented an extremely interesting and different approach to waste treatment with his subject "The Integrated Waste Treatment System for Metal Finishing." A lively question and answer period followed his talk which was illustrated with slides.

An attendance prize of $15 went unclaimed as the name of the member drawn was not present.

Homer E. Welch
Second Vice President and Publicity Chairman

Photo courtesy Hanson-VanWinkle-Munning Co.

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CHICAGO
Ladies Nite Enjoyed; Marzano Receives Award

On Saturday evening April 11, the Annual "Ladies Nite" for the Chicago Branch was held. The place selected was an ideal one, for surroundings and atmosphere. About 150 members brought their wives to the Midwest Country Club in Hinsdale, Illinois for the occasion. The gals were treated to cocktails and a fine buffet dinner including barbecued spareribs and roast beef.

After the excellent dinner, **R. Scott Modjeska** spoke a few words of welcome to the guests. He gave thanks to Librarian **Joseph C. Corre** for the wonderful program of educational sessions during the year. **Paul Glab** discussed financial matters in his inimitable style—seeking more money for the till. **Russ Harr** then introduced the officers for the coming year: **Charles Geldzahler,** president; **Matt Dassinger** first vice-president; **Rudy Hazucha,** second vice president; **Paul Glab,** secretary-treasurer; **Simon P. Gary,** librarian. The writer then received his award from the Branch for the paper on the "Production of Uranium by Electrolysis of Fused Salts." The paper was published in the September 1958 issue of PLATING. Mrs. Marion Longfield was selected to draw the lucky tickets for the door prizes. Mrs. Eileen Corre was a winner for the second time.

The program for Ladies Nite included a sound and color film of a visit to the island of Sumatra by **Robert Leighton,** renowned world traveler. Everyone enjoyed the amusing comments by Mr. Leighton during the course of the film which was educational and very interesting. All present at Ladies Nite wish to thank Chairman **Jim Vallone,** Scott Modjeska and Paul Glab, for arranging a very enjoyable evening.

Christopher Marzano

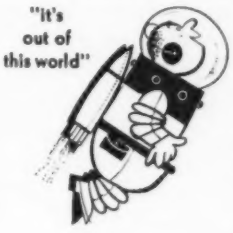
CLEVELAND
Squitero Speaks on Stripping Solutions; New Officers Installed

The April meeting was held at the Cleveland Engineering and Scientific Center. A film on die casting preceded the speaker. The guest speaker of the evening was **Al Squitero,** chief chemist for the Hanson-Van Winkle-Munning Co.

The stripping of nickel coatings was discussed by the speaker. The stripping solutions were divided into the immersion and the electrolytic types. The various reactions involved and the limitations of each type were discussed by Mr. Squitero. He stressed the importance of maintaining close control of the stripping solutions and pointed out that a stripping solution must be designed to fit the particular need.

During the business meeting **Mort Van Loan** presented four new applications for membership and the applicants were duly elected.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE B 601.



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The new officers of the Cleveland branch were installed by **Art DuRose.** The new officers are: **Jack Winters,** president; **Hank Sedusky,** first vice president; **Jim Long,** secretary-treasurer; **George Shepard,** librarian; **John Gade,** assistant librarian.

Board of Managers: **Art DuRose, Mort Van Loan** and **Bob Peters.**

Gordon Carlson has made final arrangements for the plant visitation at the Ford plant in Sandusky, Ohio.

George Shepard
Librarian

COLUMBUS

Branch Members Safranek and Miller Present Paper; New Officers Elected

The regular monthly meeting of the Columbus Branch was held at Battelle Memorial Institute on Friday, April 3.

The business meeting was called to order by President **Harry Moore.**

Calvin Smith was appointed the new junior member of the Tri-State Region.

The nominating committee consisting of Calvin Smith and **William Safranek** presented the slate of candidates for Branch offices for 1959–60. The results of the election were: **Marvin E. Pingel,** president; **Rudolf A. Skriletz,** first vice president; **Charles B. Murphy,** second vice president; **Leslie McGraw,** secretary; **Frank Gentile Jr.,** treasurer; **Hugh Miller,** librarian.

Board of Managers: **John Beach,** Harry Moore, Calvin Smith.

Librarian Les McGraw introduced the speakers of the evening, Bill Safranek and Hugh Miller both of Battelle Memorial Institute whose subject was "The Boy With the Dirty Face." Messrs. Safranek and Miller gave a very interesting talk on improving corrosion resistance of copper-nickel-chrome plated zinc die castings.

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DALLAS-FORT WORTH

Aves Speaks on Coatings for Extreme High Temperatures, R. O. Hull Jr. Discusses Future of Plating Research

The April meeting of the Dallas-Ft. Worth Branch was held Tuesday, April 21, in the Zodiac Room of the Lennox Hotel. President **Myron Browning** brought the meeting to order with 35 members and guests present. Secretary **A. C. Fricke** reported on the new members and latest financial status.

A nominating committee of **E. R. Rinehart, Ken Porter,** and **Earl Turns** was appointed to present candidates for consideration as 1959–1960 officers. The Executive board of the Branch presented results of several recent meetings to discuss (1) Branch growth programming, (2) tenets of the proposed aircraft coordinating committee, and (3) solidarity of proposals for the Supreme Society at the National Convention in Detroit. **Felton H. Havins** was presented as publicity chairman. **Blair Remaley** was appointed chairman for Branch Research Projects.

Those present at this monthly meeting enjoyed two fine speakers. **R. O. Hull Jr.,** of the R. O. Hull Co. spoke on "The Future of Research in Plating and Associated Control." He emphasized research activities in companies supplying plating equipment and chemicals. Work in alkaline copper not involving cyanides was discussed. Mr. Hull's talk was received with avid interest.

W. L. Aves, of the Chance-Vought Aircraft Co., spoke on "Coatings for Extended Range High Temperature Applications." Mr. Aves very aptly discussed protective coatings for airframe, missiles and space vehicles. Coating materials, especially desirable for refractory metals, capable of regenerative cooling, possessing heat sink qualities, and ablation properties were of major interest. Application of molybdenum to many basis metals has shown promise up to 4000F. A sound-color movie depicted high temperature testing of various platings and metallo-organics finalized the presentation.

A. C. Fricke
Secretary-Treasurer

DAYTON

Sample and Critchfield Speak at April Meeting

A regular monthly meeting of the Dayton Branch was held April 15 at the Biltmore Hotel, Dayton. A new member was welcomed.

Roy Critchfield, technical representative of R. O. Hull & Co., Inc., gave a short explanation of the EDTA method of determining metal content of various plating solutions. He demonstrated the method with zinc, cadmium, copper and nickel solutions.

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How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites—By Barnett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10* — **50 Cents**

Effects of Impurities and Purification of Electroplating Solutions, IX, X & XI—By Dr. D. T. Ewing, Dr. A. J. Smith & Dr. W. O. Dow — *Serial 34, Project 5* — **50 Cents**

Cleanability and Oil Spreading Rates—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12* — **50 Cents**

The Nature, Cause and Effect of the Porosity in Electrodeposits, I & II—By Fielding Ogburn, Asaf Benderly and Margaret Hilkert — *Serial 36, Project 13* — **$1.00**

Microthrowing Power, A Literature Search—By Esther B. Leffler and Henry Leidheiser Jr. — *Serial 37, Project 17* — **75 Cents**

The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating IV—By M. H. Jones, Chih-Yeu Lu and J. Zajdowski — *Serial 38, Project 14* — **$1.25**

Mechanical Finishing of Metal Surfaces—Bibliography—By C. E. Kennedy, J. E. Fritts, R. S. Modjeska, L E. Weeg & R. V. Twyning — *Serial 39, Project 18* — **50 Cents**

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Clarence H. Sample of the International Nickel Company discussed Plating Specifications. He reviewed the various exposure tests on nickel plated specimens and pointed out the difference in behavior of bright nickel compared with buffed Watts nickel. He urged the platers to be aware of existing corrosion protection problems and to take every possible step to obtain a better product.

Dr. Emery P. Miller, Ransburg Electrocoating Corp. will speak at the next meeting on "Electrostatic Spray Painting."

The Annual Spring Party will be held on June 5 at the Moraine Products Gun Club when the ladies will be treated to a Monte Carlo night.

L. A. Critchfield
Publicity Chairman

INDIANAPOLIS

Jumer Speaks on Electropolishing; Support Per Capita Tax Increase

Thirty members and guests of the Indianapolis Branch met on April 6 at Fox's Steakhouse for the regular meeting. After the customary introductions, **Bert Hawbee** introduced the speaker for the evening, **John Jumer** of the Alchemize and Electro-Glo Corp. of Chicago. Mr. Jumer discussed the various baths that are in use for chemical and electropolishing at the present time. The majority of the baths today use phosphoric acid with other acids and chemicals. The perchloric acid baths, although very effective for almost all metals, are not being used because of the danger of explosion if the bath is not carefully controlled. He demonstrated what can be accomplished by chemical and electropolishing with a number of "before" and "after" samples. There was appreciable interest in his talk as evidenced by the questions asked.

John Hood, Branch president, opened the business meeting. Three applications for membership were received.

Quentin Shockley reported on the business meeting of the Tri-State Region and the proposed revisions to the Tri-State Region Constitution and Bylaws. The revisions and amendments will be voted upon at a meeting to be held sometime this fall.

Addison Howard, Branch secretary, read the information and initiative resolution in regards to the proposed amendment to the Society Constitution and Bylaws raising the per capita tax. After some discussion, **Ed Bruck** moved that the delegates from the Branch would go uninstructed on this matter. The motion was seconded by **John Holland.** The motion was not carried. A motion by **Dr. Max** with a second by **Bob Little** that this Branch recognize the need for an increase in the per capita tax to the Society to meet present and future needs and to increase the services of the Society was passed.

Mr. Howard presented his resignation as secretary and delegate, as he is leaving the Indianapolis area. **Les Reynolds** moved with a second by **Roman Bender** that the president send a letter of appreciation to the secretary. Dr. Max amended the motion by adding "to accept the resignation with reluctance and thank him and wish him the best of luck." The motion carried.

A. M. Howard
Branch Secretary

LANCASTER

Tour Plating Plant; New Officers Elected

The regular meeting of the Lancaster Branch was held April 10 at the City Line Diner, Harrisburg, Pa. with 30 members and 17 guests present.

The following members were elected to office; **Chester Smith,** president; **I. Paul Sharretts,** vice president; **George Geesey,** secretary-treasurer; **Martin Frant,** librarian.

Board of Managers: **Arthur Arsenault, Curwin Miller, and Robert Plaisted.**

Our educational program consisted of a very fine tour of Charles D. Snyder & Son's industrial electroplating plant.

I. Paul Sharretts

LOUISVILLE

Annual Plant Trip

The April get-together of the Louisville Branch consisted of a visit to the new, ultra-modern electric typewriter plant of the IBM Corp. in Lexington, Kentucky.

Our thanks to **James Smith** for arranging such an interesting journey. **Ernie Lavender,** manager of plating for this plant, conducted the group through the extensive layout where a large variety of finishes applicable to the typewriter field are applied. This facility is complete with automatics, semi-automatics, barrel platers, still tanks, etc., all of which are served by a modern, up-to-date sewage disposal system.

The tour, attended by a full bus load of members was highlighted by a chartered ride to the heart of the bluegrass country, complete with a fried chicken box lunch and hot coffee. Refreshments were served from the rear of the Greyhound by **Bill Dawson** of the Pennsalt Chemicals Corp.

Louis W. Dawson
Recording Secretary

MOHAWK VALLEY

Wilson Discusses Filters

President **C. A. Bridgett** welcomed 24 members and guests to the April 9 meeting at Thompson's Hotel, Yorkville.

The Beaker Fund of $4.20 was won by **Jerome Jenny.**

Librarian **George Simmons** introduced the speaker of the evening, **Herbert A. Wilson** of Commercial Filters Corp. His

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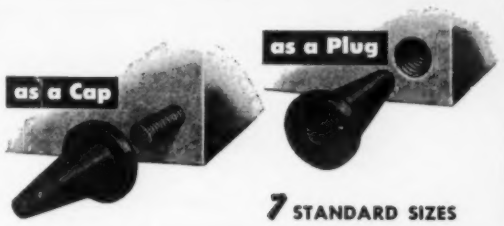

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topic was "Filters as Applied to Electroplating." He cited filtering facts not generally realized by platers. There are several materials used for filtering but cotton is the most efficient and cheapest when possible to use, as the media compatible with solutions processed. He recommended that the degree of filtration be ascertained to fit the job as often a greater degree than required means increased cost and less turnover of solution due to clogging of the fine pores. Several slides were shown of the method of manufacturing the Ful-flo cartridge and the density is varied by changing the winding space.

H. J. Crouse
Secretary

MONTREAL
Murray Speaks on Adhesion of Electrodeposits

The regular monthly meeting of the Montreal Branch was held at the Sheraton-Mount Royal Hotel on April 6.

First Vice President **R. Takeuchi** presided, with 24 members present.

Mr. Takeuchi called upon **J. T. Reisenburg** to introduce **William Murray** of Enthone Corp., speaker for the evening. Mr. Murray gave a very interesting talk and showed some excellent slides on Adhesion of Electrodeposits. Mr. Murray was thanked on behalf of the branch by **H. Baka.**

R. W. Niggemann
Secretary-Treasurer

NEWARK
Ladies Night Suitably Celebrated

The April meeting of Newark Branch was held on the 17th with over 100 taking part in the Ladies Night program. After movies by **Howard Cobb** a brief business meeting resulted in the acceptance of one application and the election of two members. It was announced that **George Wagner's** health was improved.

The program was turned over to Auntie Cyanide (**John Banta**) who buxomly carried on. First, he introduced a skit presented by Branch members (ladies for the meeting, well developed and suitably attired) **Cy La Manna, Al Korbelak, Bill Du Fosse** and **Robert Duva.** This was followed by colored shots of the Cincinnati Convention by **John Kosmos** after which John then "Mistress" of ceremonied the distribution of prizes, amid a flurry of balloons, seltzer water spritzing and pistol shooting interspersed by chatter from two winsome dark-skinned wenches left over from the skit.

Mrs. Ken Reuter won the first present from **Joe Azzollino** of Heatbath, Mrs. Carl Dowling a bird-in-a-cage from the committee, Mrs. Emil Torsh a pen from **Carl Dowling** of Sel-Rex, Mrs. Charlie Sandborn a bottle, suitably filled, from the committee, Mrs. Loretta Ehrhardt

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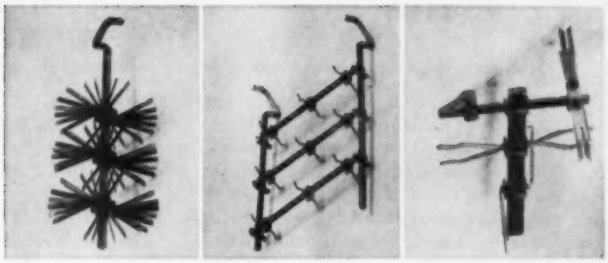

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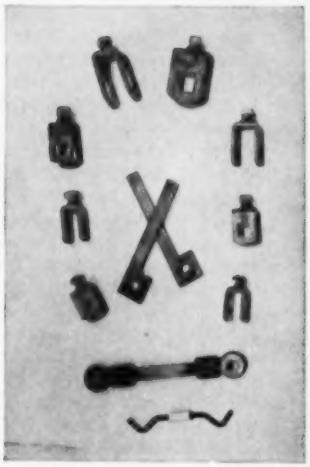

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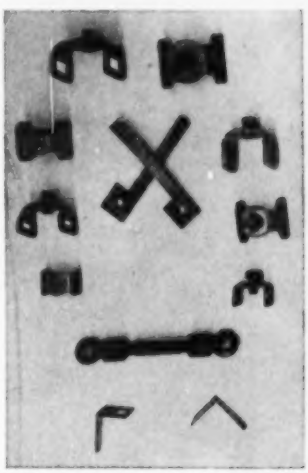

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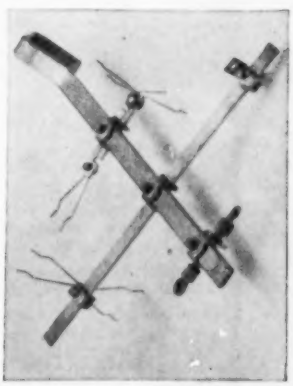

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a set of glasses from the Branch, Mrs. Lux a bag of ice cubes which suddenly disappeared as did Mrs. Sandborn's whiskey as the cast and audience made merry. Mrs. Messing then found herself with a necklace of hot dogs four feet long—with rolls to accompany the wieners—and Mrs. Garfs won a set of scissors from **Max Idel** of N. J. Instrument Corp. Then the men got into the act with **Moe Messing** winning salami and crackers, but found he had to share with a host of starving platers. Mrs. Di Fano received a gift from **Fred Gumm** and Mrs. Tilton a goldfish in a bowl and an MGM record set from **Fred Meyer** while Miss Anne Lux got a birthday cake and a present from **Gus Bittrich** of Bell Labs. Mrs. Korbelak got a bird cage complete with bird, **Bob Steiger** a wallet from the Board and **Walt Hammer** a 4-foot necklace of hot dogs. Mrs. Ross received a present from Garfield Buff, Mrs. Bittrich a goldfish bowl with fish, Mrs. Phillips a set of pinking shears from George Heuter and Mrs. Dobbs a gift from **John Cullinane** of Garfield Buff. Mrs. Kincaid, Rose Rolly and Mrs. Myron presents from **George Reuter** of Wiss, **John Trumbour** of Metal Finishing and **Bill Du Fosse** of American Plating Co., respectively. Herb Tilton and Howard Cobb got wallets from the Branch and Nancy Cullinane a perfume set from **Hal O'Brien** of Udylite. Mrs. Messing received a carafe from **Don Foulke** of H-VW-M, Mary Rose Shaw a gift from **Gene & George Wagner** of Hy-Grade, and Mrs. Ferraro a gift from Howard Cobb. Mrs. Teets received a pin from John Kosmos, Mrs. Rich a present from Max Idel of N. J. Instrument Corp. and Mrs. Tillis a silver set from **Dave Clarin, Roy Abazin, Everett Ward** and **Gene Hallet** of Oakite. The grand prize, a transistor radio presented by the Branch, went to Mrs. Walt Alina. The noisy and, to this reported, happy crowd thanked John Banta and his group with well-earned applause—and moved over to the refreshment area.

D. Gardner Foulke
Secretary

NEW YORK

Rembecki Heads New Slate of Officers; Squitero Speaks on Stripping

President **E. B. Saubestre** presided at the April 10 meeting.

A moment of silence in memory of **G. H. Hunter** was observed.

A new member was unanimously elected and duly sworn in by Dr. Saubestre.

Newly elected officers are: **Joseph Rembecki,** president; **Jack Weiner,** first vice president; **Arthur Carlson,** second vice president; **Milton Nadel,** secretary-treasurer; **Angelo Amatore,** Board of Managers; **Isidore Friedman,** finance secretary; **Martin Pollack,** librarian; **Fred Saras,** recording secretary; **Daniel B. Paris,** sergeant at arms.

Dave Clarin informed that the "Aunt Ella" party will be held June 16 at Dearborn, Mich.

A resolution being sponsored by five Branches calls for a raise in per capita taxes to our National Society. The executive board will study and make recommendations.

Librarian Arthur Carlson introduced **Al Squitero.** By the enthusiastic discussion following his talk on "Stripping of Metal Coatings," we can say his talk was very well received.

Fred Saras
Acting Recording Secretary

PHILADELPHIA

Metal Cleaning Discussed by Burkard

The regular meeting was held at the Engineers Club on April 27 with 52 at the buffet dinner; liquid refreshments were served through the generosity of Wyandotte Chemicals Corp. More than 70 attended the meeting, opened by Branch President **Farren** reading the names of the Sustaining Members in the Philadelphia area, in honor of Sustaining Members Night.

Guests were introduced, two active members were admitted and one application was received. The door prize of a

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copy of Graham's Electroplating Engineering Handbook, donated by Wyandotte, was won by **Horace McIntyre.**

The revision of the Branch Bylaws, a copy of which was sent to each member before the meeting, was approved unanimously. The nominating committee presented its slate of candidates for the 1959–60 term. Additional nominations for second vice president and alternate delegate were received from the floor.

The speaker was **P. N. Burkard,** Wyandotte Chemicals Corp., whose topic was "Recent Developments in Metal Cleaning." Following a brief description of the metal cleaning methods and important uses of the basic chemicals, Mr. Burkhard exhibited slides that covered thoroughly the many phases of metal cleaning in its most modern form. Included were various soils and recommended removal procedure; typical cleaning cycles for the various base metals; common plating troubles traceable to cleaning; effects of soils on two proprietary bright nickel solutions; methods of evaluating degree of cleanliness; various organic additives, inhibitors and surfactants used in modern metal cleaners. A curve was shown giving the variation of current density with different soils. It gave 50 ASF as the optimum for the removal of mineral oil from steel with a reverse current cleaner. Another slide showed the effect of concentration on different soils using a reverse current cleaner on steel at 50 ASF. This gave 8 oz/gal as the optimum concentration for the cleaner operated under the above conditions. Mr. Burkard was given a rousing vote of thanks for his excellent survey talk on this most important plating subject.

I. Wm. Marcovitch
Secretary

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PROVIDENCE-ATTLEBORO

Parks Made Honorary Member; Pollay Reviews Organic Coatings

The regular April meeting of the Providence-Attleboro Branch was held at the Providence Engineering Building on April 20, 1959. The following slate of officers was elected: President, **H. Leslie Ferguson;** first vice president, **William Matthew;** second vice president, **C. Capobianco;** librarian, **George Belcore;** treasurer, **Daniel Turner;** secretary, **Edward A. Parker;** Board of Managers, **Pierre Lonsbury.**

A charter member (1916) **William Parks,** who is now retired, was unanimously elected to Branch Honorary Membership. There is only one other charter member—**Arthur Wood**—still in active service at the present time.

The speaker of the evening, **H. A. Pollay** of Chemical Coatings Corp., presented a complete review of the many types of "organic chemical coatings" which are or can be used in conjunction with plated coatings. The large number of questions manifested the interest in this field and demonstrated again the need for more talks on non-metallic coatings as a supplement to electrodeposited coating.

Edward A. Parker
Secretary

ROCHESTER

Shipley Speaks on Plating on Nonconductors

The April meeting of the Rochester Branch was held at the Rochester German Club.

The meeting was called to order by President **Frank Beuckman.**

The Nominating Committee presented the slate of officers for 1959–1960.

The speaker of the evening was introduced by Librarian **Ed Penczek. Charles R. Shipley Jr.,** a senior member of the Shipley Company, Inc., gave a very interesting talk concerning plating on nonconductors. He demonstrated the process to be used and of the merits of controlling the copper deposit to gain the utmost in adhesion of the deposit to the nonconductor.

Linwood P. Morrison

ST. LOUIS

George Talks on Anodic Finishing of Aluminum

The regular monthly dinner meeting of the St. Louis Branch was held April 8 at the York Hotel. There were 34 members and guests for dinner and 50 present when President **William George** called the business meeting to order.

Craig McAlister chairman of the nominating committee suggest the following slate: President, **William Piel;** first vice president, **George Koderhandt;** second vice president, **Homer Thomen;** secretary, **Ward Kelly;** treasurer, **Louis Berra;** librarian, **Richard Gotsch;** board

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of managers, **William George, Kenneth Robins, Arthur Wrisberg;** sergeant-at-arms, **P. K. Young.**

Craig McAlister suggested everyone who possibly could should go to Detroit to see the exposition and attend the convention. We have our bid in for the 1964 convention and could learn much to assist us in our organization.

Andy Julius made a motion that the chairman of the board of managers call a meeting to discuss the details of our plan for the convention. **Ruel Shumway, Dale Bolyard** and **Lou Berra** were named as a temporary committee to work out details and meet with the board.

Librarian **Arthur Wrisberg** introduced **D. J. George,** process development laboratory, Aluminum Co. of America, who talked on "Decorative Type Anodic Finishing of Aluminum." Mr. George discussed choice of proper alloys for anodizing, mechanical finishes, bright dipping, color processing and performance of anodic films. A 20-minute sound movie showing some of the latest developments in aluminum was shown.

The good attendance at this meeting indicated the interest.

Ward Kelly
Secretary

SEATTLE-PUGET SOUND

Zievers Speaks at February Meeting; Saltonstall Presents Paper in April

The Feb. 25 meeting of the Seattle-Puget Sound Branch was held at Andy's Diner, Seattle, Washington.

After a steak dinner, **James Zievers,** vice president of research, the Industrial Filter and Pump Mfg. Co., gave a very interesting discussion on filters and pumps and their application to plating problems. A film was also shown on a recent waste disposal plant using filtration for sludge disposal.

No meeting was held in March.

The April meeting was also held at Andy's Diner, **Dr. Richard B. Saltonstall** of the Udylite Corp. spoke on agitation, the effect and need in electroplating solutions.

Helen Archibald
Secretary

WATERBURY

Trout Discusses Copper Alloys

The Waterbury Branch was forced to cancel its March meeting because of an unexpected snow fall. The scheduled speaker of the evening agreed to address the Branch at the regular April meeting. President **Ed Garland** called this meeting to order at the Roger Smith Hotel on Thursday, April 9. Technical Chairman **Al Griffith** introduced the speaker, **Delmar E. Trout** who spoke on the topic "Designing with Copper Alloys" He presented interesting information about the composition and physical properties of many widely used copper alloys and described applications in which the various alloys were well suited. It was an excellent presentation of information which is frequently not considered by the plater. Mr. Trout is a research metallurgist for the Scovill Mfg. Co. in Waterbury.

F. A. Schneiders
Publicity

WESTERN ONTARIO

Pettit Explains Chemical Milling

In the absence of our President **Dave Mainland,** the vice president, Leo Horodyski, presided at the April 8 meeting held at the Wm. Pitt Hotel.

Earl Patterson, Alex Corbitt, Les Crooks, the nominating committee, were instructed to present a slate of officers at the next regular meeting. **Jim Kelly,** librarian, introduced the speaker for the evening, **Ralph Pettit** of Diversey Corp.

Mr. Pettit had a tremendous display for his topic, "Decorative Etching and Chemical Milling." He made a difficult and strange (to most of us) subject, simple and interesting with his explanations and slides. The talk was most interesting from the word "go".

Les Crooks thanks the speaker most eloquently. He said everything most of us would have liked to say.

Leo Horodyski
Vice President

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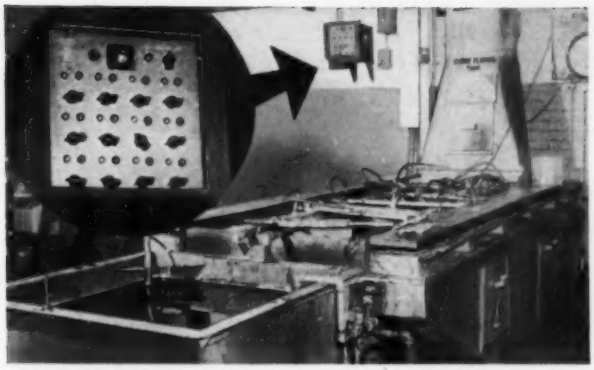

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British Columbia: V. R. Huene

Cleveland: C. Borkowski, J. M. Kopernak, A. Sidor, J. Zimm

Columbus: D. E. Semones

Detroit: P. R. Andrews, C. E. Campbell, R. R. Cech, H. Eason, L. E. Johnson, J. Kirk, R. W. Plank

Grand Rapids: G. A. Alandt Jr., F. J. Maes, D. C. Nethercot, J. F. Rogalske

Houston: R. S. Bishop, J. P. Littleton

Indianapolis: W. E. Miner, R. L. Pardieck, E. E. Taylor

Montreal: R. Perrault

Newark: A. J. Raffalovich, D. R. Turner

New York: M. Pardee, M. Stillman, J. Vazzana

Phoenix: J. Birmingham, G. M. Carlton, D. L. Catt, O. G. Craig, R. B. Craig, D. E. Fernau, B. H. Fisler, R. G. Hays, C. D. Hill, F. H. Huhn, P. E. Madden Jr., L. T. Medkiff, J. C. Mullarkey, W. D. Powers, D. A. Rodriguez, C. J. Shoup Jr., P. M. Wible

Pittsburgh: S. B. Green, W. A. Showalter

San Francisco: J. L. Beals, R. N. Christopher, A. C. Dall, L. R. Janover, A. Ali Khan, A. S. Pugliarini

St. Louis: C. R. Brahm, G. Miller, R. Goodman, W. Ripplemeier

Seattle-Puget Sound: R. C. Pommert

Southeastern: J. P. Lovoy, W. MacPherson, R. B. Taylor

Toronto: C. S. Chappelle, H. B. Jones, J. Duncan, G. N. Pascoe, L. Trimm

Waterbury: R. A. Culver, D. W. Flood, D. Lake, B. T. Lipman

Western Ontario: L. T. Trepanier

Member-at-Large: R. C. Borrowman, Surrey, England; E. S. Rucca, Mexico; C. R. Selles, Palisades Park, New Jersey; J. S. Shaw, Dallas, Texas

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St. Louis: E. W. Kunish

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Indianapolis: J. W. Tharp to Kansas City

Los Angeles: C. A. Crowley to Phoenix

Mississippi: J. H. Berg to Chicago, F. B. Bryant to Chicago

Newark: W. Jancik to Allentown-Reading

New York: I. Tsu from Dayton

Pittsburgh: A. J. Cornish to Chicago

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Western Ontario: L. Rauscher to Hamilton

Member-at-Large: W. Griff to Phoenix

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San Francisco: D. Baker, A. E. Schwartz

Toronto: R. J. Lucy

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Indianapolis: K. O. Marshall, A. E. Smith

Montreal: P. Babin, J. Bellemer, A. G. Boulmier, L. Foley, L. Seery

Newark: J. Allen, C. Busacco, K. Curry, J. Hall, H. Harris, I. Katz, J. Keating, R. Litterio, Q. Lucavello, H. Maroney, J. Ringers, C. Shutt, R. Sileneck, S. Stross, G. Thompson, P. Topelian

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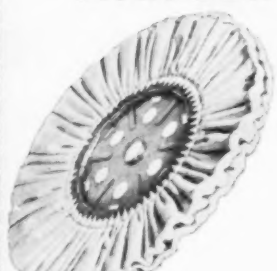

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JULY 1959

POST-CONVENTION. An abundant issue carrying not only scientific, technical and practical plating papers and other educational data of substantial readership interest but also much exclusive post-GOLDEN JUBILEE Convention news and features.

AUGUST 1959

Another annual edition of PLATING's widely anticipated WATER AND WASTE TREATMENT issue.

SEPTEMBER 1959

An issue featuring a number of important electroplating and metal finishing articles, plus many features of wide PLATING MAGAZINE readership interest, including an up-to-date copy of the AES's amended Constitution and By-laws, and a financial report covering the fifteen-month period from April 1, 1958 through June 30, 1959.

OCTOBER 1959

Several significant technical and scientific papers will be released in this strong autumn issue, plus many of PLATING's widely anticipated regular features.

NOVEMBER 1959

Third annual edition of PLATING MAGAZINE's popular AIRCRAFT ISSUE, this edition, judging by its blueprint at this stage, looms as one of PLATING's strongest future editions, a worthy follower of expectedly effective SEPTEMBER and OCTOBER 1959 general issues.

DECEMBER 1959

PLATING's always popular Christmas Issue this year implemented by several important innovations.

JANUARY 1960

Another annual edition of PLATING's vaunted "Abrasives and Mechanical Finishing" Issue.

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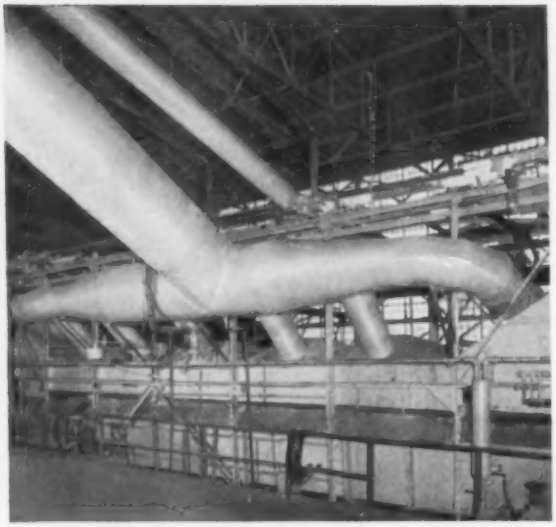

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AMERICAN ELECTROPLATERS' SOCIETY

June 15-19, **1959—Golden Jubilee Convention and Industrial Finishing Exposition, Including Fifth International Conference on Electrodeposition and Metal Finishing,** Convention Headquarters—Hotels Statler-Hilton and Sheraton-Cadillac, Detroit, Mich. Exposition—Artillery Armory, Oak Park, Mich.

August 22, **1959—Detroit Branch Stag Day,** Glen Oaks Country Club, Farmington, Mich.

January 15-16, **1960—Second Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

April 29-30, **1960—Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y.

July 24-28, **1960—47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

June 18-23, **1961—48th AES Annual Convention,** Hotel Statler, Boston, Mass.

June 25-28, **1962—49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, **1963—50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.

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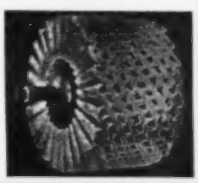

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INTERSOCIETY

June 14-16, 1959—National Assn. of Metal Finishers, Annual Membership Meeting, Hotel Statler-Hilton, Detroit.

June 15-16, 1959—National Association of Metal Finishers, Management Seminar, Hotel Statler-Hilton, Detroit.

June 21-26, 1959—American Society for Testing Materials, 62nd Annual Meeting, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

September 21-25, 1959—Instrument Society of America, 14th Annual Instrument-Automation Conference and Exhibit, International Amphitheater, Chicago.

October 7-9, 1959—American Vacuum Society, Sixth National Symposium on Vacuum Technology, Sheraton Hotel, Philadelphia, Pa.

October 11-16, 1959—American Society for Testing Materials, Pacific Area National Meeting (with Exhibit), Sheraton-Palace Hotel, San Francisco, Calif.

October 18-22, 1959—The Electrochemical Society, Fall Meeting, Deshler-Hilton Hotel, Columbus, Ohio.

October 21-24, 1959—Federation of Paint and Varnish Production Clubs 37th Annual Meeting and 24th Paint Industries Show, Convention Hall, Atlantic City, N. J.

November 2-6, 1959—41st National Metal Exposition & Congress, International Amphitheatre, Chicago, Ill.

November 5-7, 1959—American Chemical Society, Southeastern Regional Meeting. Symposium on Corrosion of Iron and Tin, Hotel John Marshall, Richmond, Virginia.

January 12-15, 1960—Society of Plastics Engineers—16th Annual Technical Conference, Conrad Hilton Hotel, Chicago, Ill.

May 1-5, 1960—The Electrochemical Society, Spring Meeting, LaSalle Hotel, Chicago, Ill.

July 24-26, 1960—National Association of Metal Finishers, 5th Anniversary and Membership Meeting, Hotel Statler, Los Angeles, California.

July 25-26, 1960—National Association of Metal Finishers, 5th Anniversary Management Seminar, Hotel Statler, Los Angeles, California.

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ADVERTISING INDEX

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A

Abbey Process Automation, Inc. 725
Abrado Finish Corporation 754
Acme Manufacturing Company 571
Acoustica Associates, Inc. 718
Alchemize Corporation 755
Allied Chemical Corp., General Chemical Division Third Cover
Solvay Process Division 556
Allied Research Products, Inc. 580, 735
Almco Queen Products, Inc. 726
Aluminum Co. of America 723
American Brass Company 742-743
American Buff Company, The 648
American Metal Climax, Inc. 554
Anderson's Plastics Company 767
Apothecaries Hall Company 759
Ardco, Inc. 729
Atlantic Compound Company 769

B

Bacon Felt Company 765
Baird Machine Company 720
Baker Company, M. E. 770
Behr-Manning Company 567
Belke Manufacturing Company 593
Berkshire Chemicals, Inc. 780
Better Finishes & Coatings, Inc. 740
Bison Corporation 776
Branson Ultrasonics Corp. 716
Buckingham Products Company, The 746

C

Chemical Corporation, The 646
Chrome Engineering, Inc. 749
Chrysler Corporation 779
Churchill Co., Inc., Geo. R. 755
Cohn Mfg. Co., Inc., Sigmund 769
Columbia Electric Mfg. Co. 729
Commercial Filters Corp. 576
Conversion Chemical Corp. 758
Cowles Chemical Co. 766

D

Davies Supply & Mfg. Co. 566
Dawe's Laboratories, Inc. 738
Day Mfg. Co., Inc., S. A. 767
Deering, Milliken & Co., Inc. 745
Detrex Chemical Industries, Inc. 560-561
Detroit Industrial Process Co. 733
Diamond Alkali Co. 588
Diversey Corporation 727
Dixon & Rippel, Inc. 776
Dresser Electric Company 747
Duggan Masking Devices 769
du Pont de Nemours & Co., Inc., E. I.,
Electrochemicals Dept. 763

E

Economy Engineering Company 754
Electrochemical Products, Inc. 574
Electro-Glo Company 772
Engelhard Industries, Inc. 577
Enthone, Inc. 551
Erie Engine & Mfg. Co., Erie-Degreaser Division 756

F

Federated Metals Div., American Smelting and Refining Co. 719
Formax Manufacturing Corp. 724
Frank, Paul 765

G

Garfield Buff Company 778
General American Transportation Corp., Kanigen Division 595
General Plate Div. of Metals & Controls Corp. 590
Globe Chemical Co., Inc., The 722
Grav-i-Flo Corp. 715
Graver Water Conditioning Co. 570
Guaranteed Buff Company 782
Gumm Chemical Co., Inc., Frederick Second Cover

H

Hanson-Van Winkle-Munning Company Fourth Cover
Harrison & Co., Inc. 778
Harshaw Chemical Co., The 562-563
Heatbath Corporation 736-737
Heil Process Equipment Corp. 782
Hull & Company, R. O. 565

I

Industrial Instruments, Inc. 777
Industrial Plastic Fabricators Inc. 717
International Nickel Co., Inc., The 775

K

Kameras Instruments 776
Kelite Corporation 597
Klem Chemicals, Inc. 774
Knight Co., Maurice A. 722
Kocour Company 757
Kosmos Electro-Finishing Research Inc. 733

L

Laramy Products Co. 741
Lasalco, Inc. 573
Lea Manufacturing Company 711-712
Lea-Ronal, Inc. 713-714
Le Vita Industries, Inc. 761
L'Hommedieu & Sons Co., Charles F. 589

M

Maas & Waldstein Company 768
Macarr, Inc. 741
Mac Dermid, Inc. 598
McGean Chemical Co., The 777
Meaker Company, The 564
Metal & Thermit Corporation 583, 584, 585, 586

N

Narda Ultrasonics Corporation 721
National Association of Metal Finishers 753
National Carbon Company 582
Nazar Rubber Company 738
New Holland Machine Co. 728
New Jersey Thermex Co., Inc. 739
Northwest Chemical Co. 558-559
Norton Company 731
Nuodex Products Company 587

O

Oakite Products, Inc. 591

P

Pennsalt Chemicals Corp. 592
Platers Research 754
Plating Products Company 765
Professional Directory 781
Promat Div. of Poor & Co. 741

R

Ransburg Electro-Coating Corp. 596
Rapid Electric Company 647
Raybestos-Manhattan, Inc., Manhattan Rubber Div. 764
Republic Lead Equipment Co. 575
Riegel Textile Corp., Bias Buff Division 761

S

Schaffner Mfg. Co., Inc. 710
Seeley Co., Inc., E. E. 761
Sel-Rex Corp. (Precious Metals Div.) 751-752
Sellers Engineering Co. 552
Servi-Sure Mfg. Co. 780
Setheo Manufacturing Co. 744
Seymour Mfg. Co., The 757
Siefen Compounds, Inc. 736
Silvercrown, Ltd. 773
Sparkler Mfg. Company 729
Spraying Systems Co. 748
Standard Plating Rack Co. 771
Stevens, Inc., Frederic B. 568-569

T

Tamms Industries, Inc. 733
Technic, Inc. 572, 770
Thermal American Fused Quartz Co., Inc. 781
True Brite Chemical Products Co. 730

U

Udylite Corporation, The 578-579
Unit Process Assemblies, Inc. 772
United Refining & Smelting Co. 749
Unitron Instrument Div. of United Scientific Co. 750
Univertical Foundry & Machine Co. 724

W

Williamsville Buff Div., The Bullard Clark Co. 581
Wyandotte Chemicals Corp. 594

Z

Zialite Corporation 767

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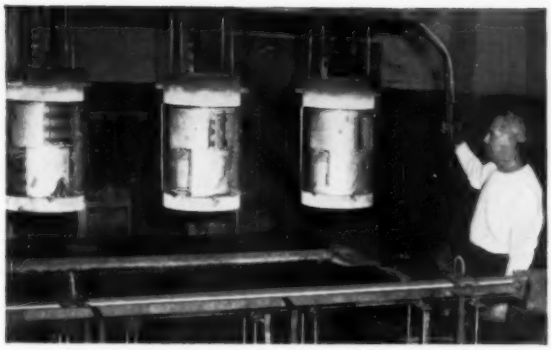

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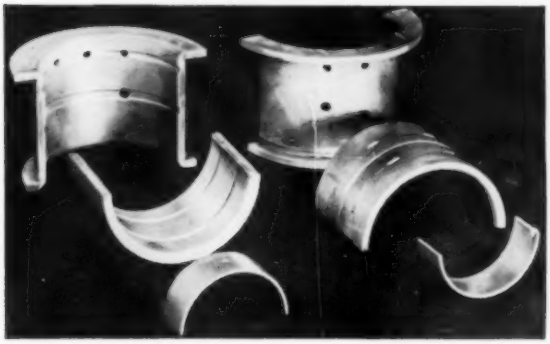

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